SCIENCE

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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

IDEALS OF SCIENCE[1]

By Dr. ALBERT FRANCIS BLAKESLEE

CARNEGIE INSTITUTION OF WASHINGTON, DEPARTMENT OF GENETICS, COLD SPRING HARBOR, NEW YORK

WE are gathered to-day to dedicate not merely a building but to perpetuate an idea—the ideals of science. It seems fitting therefore to say a few words in appraisal of science: what science has done and what it may do.

Modern civilization is in large measure the product of science. Recently, however, some have challenged the value of science on account of the baneful effects of certain of its applications. They grant the increase in material comforts which the applications have brought about, but say the cost is greater than the gain. The weapons of modern warfare made possible by science are held responsible for the appalling loss of life, rather than the wayward mind of man. Even if we should take these criticisms at their face value it would be possible to show that science has greatly lengthened rather than shortened the average span of life. Preventable disease has taken greater tolls than war. During the World War, Germany lost one and three quarter millions, killed or died during service. This is less than 3 per cent. or one out of 36 of the total population of about 65 million people in Germany at that time. During the plague of London in the seventeenth century, 15 per cent. of the population, or more than one in seven, died of the Black Death during a two-year period. This is ten times the German mortality rate during the World War. Later when the plague was introduced into Marseilles it killed almost half the population there. During the seventeenth century the plague carried off twenty-five million people in Europe, or a quarter of the population.

The plague has been a periodic scourge to mankind since long before the time of Christ, but thanks to the applications of science we no longer dread its ravages.

[1] Address delivered at the dedication of the John H. Harrison Science Building at DePauw University, Greencastle, Indiana, October 19, 1940.

Other examples could be given to show that the discoveries of science have saved more lives than have been lost through the applications of science.

These arguments against science are based upon a misconception of what science can do. Science is impersonal. It merely provides tools in the form of a body of knowledge, instruments such as the microscope with which to delve deeper into the unknown, methods of studying nature, and points of view. How these tools are used is not the fault of science as such. The use is determined by the aims of human beings, some with good and some with bad motives; some ignorant, some informed. Goodness of motive does not alone determine whether an action is beneficient or baneful. Witness the inquisitions of the church in their well-intentioned campaigns to better mankind, and the Salem witchcraft trials which are connected in the public mind with the Reverend Cotton Mather. In the Civil War, churches on both sides prayed for the success of their own cause and the same was true in the last World War. Even the Church follows the flag. Moral judgments when colored by personal interest are unsafe guides to conduct.

It is true that technological applications of scientific discoveries have brought us material comforts, but they have been too often recounted and their emphasis tends to obscure the real values of science. Technological applications and physical comforts are not the greatest gifts that science has to offer to mankind. Lincoln has been called an emancipator. He liberated people from physical bondage. Science has been a greater emancipator. It has liberated humanity from the shackles of ignorance and superstition. It has freed men's minds. It has disclosed nature and from this knowledge man may walk in accord with nature's ways. The influence of science on human betterment is usually indirect. As an example, the ancients used human sacrifices to ensure bountiful harvests. We use commercial fertilizers, not primarily because we feel human sacrifice is morally wrong, but because we have learned by experience that commercial fertilizers yield better results. With new knowledge superstitions based on untenable premises gradually fade away. Thus before the behavior of chromosomes and genes was understood, it seemed reasonable to believe in "maternal impressions"—that, for example, if a pregnant mother was chased by a turkey gobbler, the child's face was likely to be "marked" with a red birthmark. Such a belief, as also that in so-called "acquired characters," is no longer held by informed people, since it runs counter to the known mechanisms of heredity.

The recent findings of genetics in plants and lower animals are having a profound effect upon man's philosophy of life—or should have. The realization that no two people are exactly alike or ever have been, that human differences are due to factors of heredity which are innate as well as to influence of the environment, can not but change our attitude toward problems of education, rewards and punishments, and all efforts for human betterment. The environment can be readily controlled; the heredity can be controlled only by genetic methods. There seems no good evidence that man to-day is inherently better physically, mentally or morally than at the dawn of history. Through changes in environment, however, man has risen far in social evolution. Many of the gains have been called moral, since they tend to benefit mankind as a whole. This does not prove that the moral nature of man has changed. It may merely show that what we call morality has been found to be profitable in the long run. Despite lapses of individuals and of nations, I believe morality does pay and will prevail as the recognized standard of life. Those who think otherwise I trust in time will come to agree with the man who said, "Honesty is the best policy. I have tried both." Time may come when man will attack the problem of his own biological evolution and man may then become better morally as well as mentally and physically.

Last month I had the privilege of taking part in the Bicentennial of the founding of the University of Pennsylvania in 1740 by Benjamin Franklin. It was interesting to review the state of science at that time. In the first place, there were no laboratories then and few who could be called scientists. Franklin probably knew personally or through correspondence all the scientists there were in this country and most of those abroad. In Franklin's time there was hardly a chemistry since the atomic theory had not yet been proposed by Dalton. Two hundred years ago a little was known about static electricity, but the Leyden jar was not yet discovered and nothing was known about galvanic and induced electricity. Here are some of the biological things that were not known two hundred years ago: the binomial system of naming plants and animals, later introduced by Linnaeus; bacteria as causes of disease; experimental work in hybridizing plants, started by Koelreuter; the cell theory; the theory of organic evolution; chromosomes, genes, hormones, vitamins. Knowledge of the mechanisms of heredity has been developed entirely within the last forty years. It is certainly true for biology and perhaps for most other branches of science that more progress has been made in the last one hundred years than in all time before. Equally important examples could be mentioned from other fields. The selected items I have mentioned that Franklin did not know are not technological advances but fundamental discoveries, many of which have, however, formed the basis for technological applications of great value.

Franklin, though perhaps the foremost citizen, philosopher and scientist of his time, knew relatively little of the orderly processes of nature. To him the universe was fashioned in six working days by a mechanistic God. To his time, all men were created equal and environment (with the occasional aid of Divine Grace) was considered the sole arbiter of man's fate.

In Franklin's time science had little or no place in the educational curriculum and there are those to-day who would deny cultural value to study of nature. To us, science is not to be defended primarily because of its utilitarian values except perhaps in such professional schools as those of engineering. It should rank in cultural value with art, literature, and music, since science also nourishes the spirit.

I had chosen as my topic for this morning's talk "The Ideals of Science." I have come to the conclusion, however, that strictly speaking there is only one ideal of science—the search for truth. The searchers for truth, the scientists, have developed ideals for their endeavors, but they are human beings with human emotions and frailties and, like the rest of humanity, their opinions are consciously or unconsciously tinged by personal interest. Personal interest, however, does not give added weight to conclusions of science. We need emotion as a motive force to our labors, but the more heat in our emotions the more likely we are to be blinded in our conclusions. First among the ideals of scientists is freedom of thought and its expression. A censorship on what problems may be studied and on what conclusions may be reached is lethal to science. The scientist covets for all the freedom to investigate any problem, economic, social, governmental or other human activity as well as problems of genes and electrons, and to state conclusions whatever their effect on current beliefs. In his search for truth, the scientist attempts the difficult task of accepting realities though unpleasant. With Thomas Huxley he can say "God give me strength to face a fact though it slay me."

Cooperation is an ideal of scientists. Whether we realize it or not, each is working with a multitude of collaborators, of the past and of the present. Discoveries are not made in a vacuum but are the culminating result of the labors of many on whose shoulders we rise. The present also has an unconscious influence. We often hear the expression "Leaders of Science." As a matter of fact so-called leaders often lead less than they are pushed. The advancement of science is like that of an amoeba—a mass movement with individual projections extending only a slight distance beyond the advancing edge. It is for this reason that so frequently important discoveries have been made independently at about the same time. This was the case with the rediscovery of Mendel's law of heredity. Mendel communicated his discovery to Naegeli, an acknowledged leader in heredity, and his published paper was cited in Focke's "Cyclopedia of Hybridization." Mendel's discovery remained unused for over thirty years, until 1900, when it was independently rediscovered by three other investigators. Biologists in unconscious cooperation had brought their science to a stage in 1900 at which the early discovery of Mendel's law was an inevitable event. If de Vries, Correns and Tschermak had not made the discovery, others would have done so soon.

Another example near our day. Thirty-six years ago, at our Department of Genetics in Cold Spring Harbor, a building was dedicated to the study of experimental evolution. Hugo de Vries, the world's leading student of heredity, was brought from Holland to make the address. He advised the use of the recently discovered radiations of radium and x-rays to penetrate into the interior of cells and induce mutations in what we now call genes. Some of the leading geneticists of the time heard the address and it was published, but again the time was not ripe and the advice fell on stony ground. About twenty-five years later the effective use of x-rays in inducing gene mutations was announced by a worker with *Drosophila,* but others independently had already started radiation experiments for the same purpose. None of these workers had known of the advice of de Vries. The stage was set for the discovery, and it could not have been long delayed. My purpose in giving these examples, which I believe are not exceptional, is to emphasize the part that the scientific environment plays in the advancement of science. The individual so-called leaders of science could probably be eliminated without so much loss as most would imagine. It is the mass movements that really count. They furnish a scientific atmosphere, as it were, to which we all may contribute our bit.

I need not stress the obvious advantages of voluntary cooperation, especially between those with different techniques and different points of view. Science knows no bounds of nationality or creed. There is not a Japanese wave-length of light nor a German atom of carbon. Consciously or unconsciously all nations have cooperated in building our present structure of science. International congresses testify to the value of international cooperation in science.

Another ideal of scientists is tolerance. The experienced investigator knows too well how hard it is to close every rat hole where an error might have crept into his calculations. His chief demand of others, as of himself, is honesty and a reverence for the truth and withal a willingness to change his opinion when facts show his views are wrong.

Science may be advanced in many ways. We think of research, education and support by public and private

agencies. Each plays its special part. Few can compose music; most of us can enjoy music and some can help in the financial support of music. Patrons of the arts have made possible our present museums with their priceless treasuries of the best thoughts of the past. It would be as unwise to attempt to force all into careers of research as into careers of musical composition. All, however, should have the privilege of knowing and enjoying at least some phase of science. The problem regarding the supply of new leaders of science is to catch them early and give them increased opportunities for the development of their exceptional powers. The problem for those who are enjoyers of science without professional intent is the accurate but interesting presentation and dissemination of scientific knowledge. Beside the formal educational institutions, such agencies as Science Press and the members of the National Association of Science Writers are contributing to the solution of this problem. The problem for the potential patrons of science is the realization that their benefactions are investments in science which should be scrutinized as carefully as a purely financial venture in order to ensure adequate dividends in scientific returns. We congratulate this university that its patron not only provided the funds with which to erect this beautiful temple of science but also had the foresight to provide a permanent endowment in the university which could be used towards its continuing support.

These are dark days throughout the world when in many countries science has been as effectively bombed by governmental fiat as have stately edifices been bombed by missiles from the air. What of the future of civilization, we are asked, and what part has science to play? Turning the pages of history gives us scant comfort. Civilizations widely separated in time and space have flourished and disappeared. Is ours also to obey the laws of growth, decay and death? In the warm summer it is hard to think of winter's cold, and we instinctively feel that our civilization will endure; we have gone so much farther on the upward road, we say, that the curve must continue to rise. It is dangerous to extrapolate the future from the present. Think of the temperature curve of H_2O. Starting with water at room temperatures there is a gradual decrease in volume until at 5 degrees the volume begins to change in the opposite direction and a sudden expansion takes place as the liquid changes to a solid, ice. From the slight range of room temperatures it would not be possible to predict the sudden reversals of the curve, as water freezes. It is equally impossible to be sure that the curve of our civilization will continue its upward trend. There is one fact, however, that may be a ray of hope to our calculations. Science has reached a stage of development in our time that no other civilization has known. The experimental method, for example, has only recently become of use. Scientific methods are now available as never before for study of all phenomena of nature, even that of a sick civilization. It is my trust therefore (though this may be wishful thinking) that science will find a remedy for our present international ills as it has for many a pestilence that walketh in darkness. If and when the time comes for restoration of peace and good will, I believe science may lead the way. I attended the International Congress of Genetics in Edinburgh last fall which was broken up by the advent of war. Some of the members belonged to countries where now liberty is but an empty name. Science had brought us together individually as friends and we separated as friends when the congress was prematurely disbanded. We trust that the internationality of science will some day bring us together again as friends.

We are all the privileged legatees of the past, rich from the toil and sacrifice of those of other days. America is favored as nowhere else. Our science is still free. American science therefore has an especial duty to keep aflame the torch of free research for truth, which is dimmed or gone out in so many lands. We believe that when the goddess of truth is seen snatched from her temple and publicly trampled under foot, our duty is not merely to mildly protest but to summon up our emotions as men and to fight with all the moral energy at hand, fight not merely for the preservation of our own land and the spiritual values we have gained but for freedom throughout the world. In science all nations are one people and the world can not endure part free and part slave. We are not without hope in the ultimate salvation of mankind. We believe that the free search for truth by the methods of science has power to rebuild the world and we have faith that it will prevail.

THE STATE SCIENTIFIC SURVEYS OF ILLINOIS[1]

By Professor W. A. NOYES

UNIVERSITY OF ILLINOIS

THE Board of Natural Resources and Conservation is a non-political organization, the members of which are appointed by the governor of the state but are selected because of their expert scientific training in lines closely related to the work of the State Surveys. The original board was appointed in 1917 by Governor

[1] An address given at the dedication of the Natural Resources Building at Urbana, Illinois, November 15.

Lowden and included such men as T. C. Chamberlin and John M. Coulter, of the University of Chicago. William Trelease and I of the University of Illinois were also appointed by Governor Lowden and have been reappointed by successive governors, irrespective of their political affiliations or of ours. The board controls the work of the surveys and approves all appointments of the employees, including the chiefs. No member of the staffs of the surveys has ever been appointed for political reasons.

The Geological and Natural History Surveys are housed in the building which we dedicate to-day. The building has been constructed with funds supplied by the state to the Department of Education and Registration. The Federal Government has also furnished, through the P.W.A., a very considerable part of the fund used. The State Water Survey has its office and laboratories in quarters furnished by the University of Illinois in the chemistry building.

The State Water Survey studies the water resources of the state, which have a value of more than 50 million dollars annually, in spite of the fact that water is said to be free as air. During recent years it has developed methods of fermenting the organic matter of industrial wastes which were formerly allowed to run off in the streams of the state, killing the fish in some of our large rivers. The fermentation yields methane, a gas used for heat and power, and worth enough to pay for the cost of the process. Very recently the survey has been studying the structure of the water molecule in cooperation with the division of physical chemistry in the department of chemistry. The results are of great importance scientifically and also of value in biology and in industry.

The members of the State Water Survey have recently been called upon to do important work for the national defense.

The Geological Survey has become an integral factor in the industrial development of the state. Its researches aid the mining and quarrying industries, those manufacturing industries which use minerals as raw materials, the various railroads in their development of industries along these lines, engineers engaged in the design and construction of large structures, bridges and pavements, and cities and industries throughout the state who seek more adequate sources of ground waters. It helps the clay industries of the state. The large coal resources of the state are also of great importance. All these are of vital consequence to our standards of living. In certain phases of its work the Geological Survey cooperates with the Department of Ceramic Engineering and the Department of Mechanical Engineering of the Engineering Experiment Station and with the Department of Geology of the University of Illinois, and also with the Departments of Geology of the University of Chicago and of Northwestern University. To the Geological Survey is entrusted the topographic mapping of the state, and in this work it cooperates with the U. S. Geological Survey.

With national defense looming large, the mineral resources of Illinois, located in the interior of the continent, promise greater development. In 1938, the value of the mineral production was 160 million dollars, and in 1939, 283 million dollars, an increase of 123 million dollars. Significant is the fact that Illinois' new oil fields, in whose development the Geological Survey played an important part, produce three times as much oil as the fields of Rumania produced just before the opening of the present world war. With industry necessarily playing a vital part in the national defense program, the Geological Survey's contribution in research and advice will be of greater value and in greater demand.

The Natural History Survey is concerned with research in the state's great wealth of renewable natural resources, those resources that under adequate protection and wise utilization are inexhaustible. In certain phases of its work it cooperates intimately with the Agricultural Experiment Station of the University of Illinois.

Upon the results of the experiments of the Natural History Survey are based control measures for the destructive insects and diseases that threaten agricultural crops, income from which approximates annually a half billion dollars in value, the greenhouse industry with its annual crop value of fourteen million dollars and the forest industry with its six million dollar annual income. These figures do not include the income from nursery products, truck crops and numerous smaller but important industries associated with some phase of agriculture or with utilization of renewable natural resources. When the destruction of a large part of the corn crop was threatened by chinch bugs, a few years ago, it is estimated that through the advice of the Natural History Survey of the Agricultural Experiment Station a loss of three million dollars to the farmers of the state was prevented.

Upon the results of its studies are based management practices intended to preserve and increase the once abundant but long neglected wild life of the state, the fish, the furbearers, the waterfowl, the quail, the prairie chicken and other upland birds. The value to the people of Illinois of the wild-life resources transcends their estimated monetary value over a million dollars annually for furbearers, nearly half a million dollars annually for waterfowl, birds and small animals. The 400,000 Illinois citizens who annually purchase fishing licenses, the 280,000 who annually buy

hunting licenses find in their close association with the outdoors an esthetic value far above any monetary value they derive.

In times of international stress, the wild-life resources of the state become of increased value as a means of taking its citizens into the open and of preserving their mental balance and their collective sanity. In times of national emergency, the food resources of a country are its first line of defense. Protection of its agricultural crops from the ravages of insects and diseases is a primary objective in any effective defense program.

THE RESEARCH LABORATORY OF THE GENERAL ELECTRIC COMPANY[1]

By Dr. WILLIAM D. COOLIDGE
VICE-PRESIDENT OF THE COMPANY AND DIRECTOR OF THE LABORATORY

THE significance of our laboratory's work, in its three aspects—to our company, to the world of science and to industry—has been discussed by Mr. Wilson, Dr. Compton and Mr. Ferguson, respectively. They have been most generous in awarding us credit on all three counts, and those of us here, who are working, or have worked in the laboratory, have been heartwarmed and thrilled by their exceedingly kindly appreciation. We know each of them well enough to know his complete sincerity, so we accept their praise at its full value and acknowledge it with deeply sincere gratitude. Their mere presence here would be, were it needed, complete proof of their interest in our work, for, even in these busy and anxious days, it would be hard to select three men who are carrying heavier burdens and responsibilities than are, each in his own field, these three. For their taking time to come to this birthday party and for their most kindly contributions to it, we return our heartiest thanks.

We offer our thanks also to the civic leaders of cities where our plants are located, to the science editors and other representatives of the press, to the educational and industrial leaders of our own city and to our many friends in the General Electric Company who have graced this celebration by their welcome presence.

For me to add anything to what the preceding speakers have said about the laboratory's work would be in the nature of an anti-climax, but, since they have spoken, as it were, from the outside looking in, so perhaps I may say a few words from the inside looking out, in regard to the relations of the laboratory to science and industry, or rather perhaps on the aspect of the laboratory as a catalyzing agent which has helped to bring about a momentous reaction between the two.

Forty years ago the attitude of science toward industry was mostly one of aloofness, frequently tinged with contempt, while industry for the most part ignored the existence of science. To-day we find some 50,000 scientists contentedly domesticated in the 2,000 industrial research laboratories of this country, while industry, with considerable assiduity and often with generosity, caters to their peculiar needs.

In bringing about this startling change in four decades, I believe our laboratory, as a pioneer in industrial research, has been a contributing factor.

I think the hesitation which was manifested by both Dr. Whitney and myself on embarking on industrial research was symptomatic of the general attitude of scientific men. That hesitation in my case was caused not at all by any such feeling as was then entertained by many scientists that science would be soiled by close industrial contacts, but simply by my doubt that industry could present such fascinating problems as lay before me at M. I. T., or problems which would offer equal opportunity for worth-while work. The same was true with Dr. Whitney, I am sure. Indeed he had already made an application of his experimental work to profitable industrial ends. But he too evidently doubted if industry could offer enough problems of interest to occupy his full time to advantage, for he at first arranged to divide his time between Schenectady and Boston. It was not many months, however, before he realized that in the General Electric Company were enough interesting problems to keep himself and a growing staff of assistants busy for a lifetime and more, so he ended his connections with M. I. T. and devoted all his energies thereafter to building up the Research Laboratory here.

My own experience was similar. I was persuaded by Dr. Whitney to join him only by his invitation to bring with me the apparatus with which I was then working at M. I. T. and his assurance that I would be given all the time to devote to it that I desired. But I too soon found more engrossing problems here, so I shipped my apparatus back to Boston, leaving further experiments with it to other hands.

It was not long before the results of our laboratory's work began to appear in the products of the company, in new materials, more efficient processes and new devices, some of them opening up wholly new fields for electrical development. Other pioneer laboratories in their different fields were similarly demonstrating the utility of research in industrial problems,

[1] Address given on December 17 at a dinner on the occasion of the celebration of the fortieth anniversary of the founding of the laboratory.

and as papers were read at meetings of the scientific societies, presenting the problems that had been met, their solutions through applied research and the value of the outcome to the public, scientists in general came to realize that there was a tremendously worth-while job for science to do in promoting the nation's industrial progress.

At the same time, I think, the supercilious aversion on the part of some scientists to industrial contacts faded out. It was at one time a very real thing. Hardly a quarter century ago, thirteen or fourteen years after our laboratory was started, there was another General Electric laboratory in another city which was headed by a scientist obsessed with that aversion in extreme form. His laboratory had accumulated some data which might be helpful in a development of ours, so a letter was written asking for them. His reply was that he feared we contemplated making use of those data in some commercial development, and in that case he would be unwilling to give them to us. I don't know whether he had time to change his attitude toward commercialism, for his association with industry was rather brief.

If there is a scientist to-day who regards industry as barren of interesting problems or contaminating in its contacts, he must be a rare bird, for I do not know one of his species.

Meanwhile industry's attitude to science has been undergoing a change equally profound. During the first fifteen years of our laboratory's existence, the relatively few companies maintaining research laboratories were accumulating proof of their value, but it took the experience of the last war to bring home to American industry what industrial research really means. When the British fleet took its strangle-hold on German commerce, our industries were forced to realize how dependent they had become on the output of German laboratories. Dyes, anesthetics and other essential drugs, optical glass, chemical reagents, magnesium metal and powder and many special alloys were no longer obtainable. American research mobilized to supply the lacks, and, when the United States entered the war, made very important contributions to the national defense. Had it not been for the few industrial research laboratories then in existence, and the university scientists who volunteered or were drafted for the emergency, American industry would have been in worse straits and our Army and Navy would have lacked some of their most effective defense facilities.

While the lessons of the war were fresh in the American mind, the National Research Council undertook to drive home the implications of those lessons, to make industry research-conscious, and to advise in the organization of research, both by the larger individual companies and by industries when the companies composing them were small.

In consequence there are now nearly two thousand industrial research laboratories, and organized research has come to be accepted by industry as an essential activity, as necessary for progress and prosperity as financial control and accounting.

A comparison of conditions to-day with those of forty years ago reveals a change which is fairly revolutionary. The leaders in the revolution were those companies which pioneered in research. But their leadership would have been ineffective, if they had not been able to demonstrate to science and industry alike that industrial research could be a plentiful source of both scientific and industrial progress. The creation of the research era of American industry required more than the fiat—let there be industrial research. Laboratories had to be so organized and directed that the scientist would find in them opportunity for the full exercise of all his ability, and problems calculated to arouse his enthusiasm and inspire his best efforts, while at the same time the industrialists must be able to derive from them products which would increase business and profits. To accomplish such a fusion of the scientific spirit with the profit motive, to inspire enthusiastic team-work within the laboratory, while knitting the laboratory's work, through full cooperative effort, into the company's organization with its diverse activities of engineering, manufacture and sales, required leadership of a new and different kind. The success of an industrial research laboratory in its early years depends almost wholly on the quality of its leadership.

Those of us who have been long in the laboratory and can remember the difficulties under which we often labored in its early years, the frequent failures and disappointments, remember also the sympathetic encouragement, the infectious enthusiasm, the resourceful suggestions and the unflagging assistance we derived from our leader.

And so to-night, thrilled as we have been by the kindly tributes to our laboratory and its achievements, we realize with gratitude and affection how much of the credit should go to our laboratory's founder and builder, Dr. Whitney.

OBITUARY

RAYMOND PEARL

RAYMOND PEARL possessed, to an exceptionl degree, knowledge, originality and an intellectual drive which were a stimulus to all who had contact, either directly or indirectly, with the products of his mind. A pioneer in the application of quantitative methods in

biology, he gave great impetus to the development of this field, both through his own extensive research and through the training of students. His sudden death on November 17 cut short an extraordinarily productive career, the influence of which has been world-wide.

Born in Farmington, New Hampshire, June 3, 1879, Raymond Pearl received his undergraduate training at Dartmouth College with the class of 1899, and his graduate training at the University of Michigan, obtaining his doctorate in biology in 1902. He was married in 1903 to Maud M. DeWitt of Sandusky, Ohio, who was also a biologist and became an active collaborator in Dr. Pearl's work. Two daughters, Ruth DeWitt (Mrs. G. P. Jencks) and Penelope Mackey, were born to them.

Dr. Pearl remained with the University of Michigan as instructor in zoology for four years after taking his degree, the last year of this period being spent in study at Leipzig, the University College at London and the National Zoological Station at Naples. In London he studied with Karl Pearson at the Galton Laboratory, and this contact with the new field of biometry and the active minds that were developing it had a profound effect on the future direction of Dr. Pearl's career. His interest in quantitative studies in biology had, however, been evidenced before his London experience, for as early as 1901 he had done research on variation of fishes while working with the U. S. Fish Commission on a biological survey of the Great Lakes.

Returning to this country, Dr. Pearl spent one year as instructor in zoology at the University of Pennsylvania and then became biologist and head of the department of biology at the Maine Agricultural Experiment Station, a position which he held until 1918, when he came to The Johns Hopkins University. His principal studies at Maine were in connection with poultry and they covered many problems of fundamental importance in genetics, disease, and population aggregates. Two books written during this time (with F. M. Surface and M. R. Curtis), "Poultry Diseases and Their Treatment" (1911) and "Diseases of Poultry" (1915), greatly advanced the concepts in this field and have served as a guide to subsequent work along this line.

Following the war, in which Dr. Pearl acted as chief of the statistical division of the U. S. Food Administration, he became a professor at The Johns Hopkins University where he remained until his death. In 1918, the School of Hygiene and Public Health was established at this university and Dr. Pearl was appointed its first professor of biometry and vital statistics, a position which he held until 1925. The breadth of his academic activities is indicated by the fact that he served the university in the following positions: As director of the Institute of Biological Research and as research professor in the School of Hygiene and Public Health from 1925–30; as statistician for The Johns Hopkins Hospital from 1919 to 1935; as professor of biology in the School of Medicine from 1923 until his death; as professor of biology in the School of Hygiene and Public Health from 1930 to his death.

His greatest interest through this career at The Johns Hopkins University was in the quantitative approach to the biology of man and of other animals in population aggregates. A vast amount of material collected by Dr. Pearl and his coworkers through field studies, hospital records, experimental studies, vital statistics reports and other published works, were analyzed for their quantitative relationships in inheritance, longevity, reproductive patterns, growth, population size and vitality. It is impossible to cover in a brief space the colossal amount of work Dr. Pearl accomplished in both the collection of data and their analysis during the past twenty years. Seven of his books, written during this period, present some of the results of this endeavor, and their titles indicate the range of his interests: "The Biology of Death" (1922); "Studies in Human Biology" (1924); "The Biology of Population Growth" (1925); "Alcohol and Longevity" (1926); "The Rate of Living" (1928); "Constitution and Health" (1933); "The Ancestry of the Long-Lived" (with Ruth D. Pearl) (1934); "The Natural History of Population" (1939). In addition to these books in the field of human biology, Dr. Pearl also wrote a text-book entitled "Introduction to Medical Biometry and Statistics," the first edition of which was published in 1923, and the third, a complete revision, in 1940. All of these books, as well as his numerous contributions to scientific journals, contained new ideas which were out of the general pattern, and were provocative of thought and discussion. As is always the case with the output from such a mind, his work challenged and met opposition, and thus demanded careful evaluation of data, and clear statement of hypotheses. Its value lies, therefore, not alone in the share it has given to the present accumulation of scientific knowledge, but also in the spur that it has been to the thinking of workers in science.

The two scientific journals which Dr. Pearl established, *Quarterly Review of Biology* and *Human Biology*, fill a very unique place in the scientific literature. His editorial work in these journals had been shared by Mrs. Pearl, who is now assistant editor of the former and managing editor of the latter. Dr. Pearl also had acted as associate editor of seven other journals in this country and abroad.

The recognition which Dr. Pearl received throughout his career came from so many sources that it is not possible here to present a list of the numerous honors accorded him. He was a frequently sought lecturer, the recipient of honorary degrees from three

institutions, a member and fellow of many scientific and honorary societies in this country and abroad. He served at some time as president of a number of these societies, on the council of the National Academy of Sciences and on the executive board of the National Research Council.

One of the founders of the International Union for the Scientific Investigation of Population Problems, Dr. Pearl served as its first president. He gave a great impetus to a movement that has turned serious thought to problems of the utmost importance to students of social trends.

Dr. Pearl was a very wide reader, and the enjoyment and profit which he found in his general reading was evidenced in his book "To Begin With" (1927) in which he made an appeal, particularly to graduate students in science, to discover for themselves the satisfactions to be gained through reading.

In music, also, Dr. Pearl found especial satisfaction, devoting much of his meager leisure to it. Brought up in a musical family, he had at one time or another played most of the wind instruments, and after coming to Baltimore in 1918, he undertook to master the difficulties of the French horn. He became very proficient and for many years had played in two amateur musical clubs of which he was a member.

For a person of Dr. Pearl's enormous activity, it is perhaps fitting that he should stop in the midst of things. His work, however, has not come to an end, for within the university which he served, to the students whose minds he stimulated and in the scientific world to which he made such vast contributions, his influence will continue indefinitely.

LOWELL J. REED
SCHOOL OF HYGIENE AND PUBLIC HEALTH,
THE JOHNS HOPKINS UNIVERSITY

SCIENTIFIC EVENTS

DAMAGE FROM BOMBS TO THE ROYAL BOTANICAL GARDENS AT KEW[1]

IT is so long since I have heard anything from you, or you from me, that I know you will be very grieved to hear how greatly Kew has suffered from enemy action.

Several high explosive bombs have dropped in the Gardens, as well as oil bombs and incendiary ones. Until recently we had not suffered very much damage, as the big bombs which fell were in the far parts of the Gardens. One fell at the north end of the Rhododendron Dell, where it only rooted up a few ordinary Rhododendrons and, of course, made a huge crater. The others fell in grassy spots in the Queens Cottage Grounds and made craters some 25 feet across, but did no damage otherwise, and the oil and incendiary bombs fell on lawns in various places and did no particular harm. A few days later some 6 smaller bombs were dropped near the Isleworth Gate and some were also dropped in the Sion House Meadows across the river. These damaged a good many trees. Some three weeks ago, however, a bomb fell on a house in the Kew Road, close to the Cumberland Gate, and very much glass was broken in Museum No. 1 and in the Orchid Houses, the Sherman-Hoyt House and other places. A bomb which fell on the other side of the river, at Brentford, caused a good deal of damage to the Herbarium, as the blast broke about 100 panes of glass in the middle wing, and a bomb which fell at the foot of Kew Bridge, on our side, broke much glass in No. 4 Museum and in most of our houses along the Kew Road.

Our worst damage unfortunately took place about a week ago when a bomb fell in the early morning in front of a house in the Kew Road, near the North Gallery. The blast from this blew down some 60 yards of our boundary wall and did much damage to the North Gallery and the two adjoining houses in the Gardens. The pictures in the North Gallery, however, had all been removed some time previously to a place of safety. The blast from this bomb also smashed thousands of panes of glass on the east side of the Temperate House, and I fear it will be impossible to repair the damage and should there be a bad winter, no doubt many of the fine specimens will perish. About the same time another bomb fell between the Palm House and the Azalea Garden and destroyed a number of interesting trees in the Ash collection and the blast smashed many hundred panes of glass in the Palm House itself and in the Water Lily House. Here again it will be very difficult to effect repairs and save some of our unique plants, but I am hoping that we shall be able to make sound the southern end of the Palm House, where magnificent Cycad specimens are housed. On the evening of the same day, three bombs fell again near the Temperate House, one in the Heath Garden to the West of King William's Temple, where many interesting Chinese Rhododendrons, Arbutus and other plants were smashed to atoms, and the blast from this bomb broke much more glass in the northern end of the Temperate House. An oil bomb fell close to the Temperate House, but as this smashed a water main, no particular damage was

[1] Dr. E. D. Merrill, Director of the Arnold Arboretum, submits this private letter, recently received from London, indicating the extent of damage to the Royal Botanic Gardens at Kew from indiscriminate bombings. The Director of the Royal Botanic Gardens is Sir Arthur Hill, recently honored by being awarded the George Robert White Medal of the Massachusetts Horticultural Society.

done. The third bomb was a delayed action one, and this I am glad to say has been safely removed before it exploded. It was found to be some 16 feet down and was about 500 pounds in weight. Since then I am glad to say we have not suffered, though several bombs have fallen to the south of us in the Old Deer Park.

I am hoping it may be possible to find accommodation for some of our rarer plants from the Palm House and Temperate House in some place of safety. We are also taking steps to move some of the Herbarium specimens, but with the indiscriminate bombing which is taking place, it is very difficult to find any place which may be safe from enemy attack.

I know that you and other kind friends in America will be very much distressed to hear how Kew has suffered from enemy action, and I much hope that we may be left in peace and that we shall suffer no further damage, as there is no sort of military objective anywhere in this part of the world.

Your sympathy and help are very much appreciated by all of us.

ENGINEERING DEFENSE TRAINING

DEAN S. C. HOLLISTER, of the College of Engineering, Cornell University, has been appointed regional adviser for the State of New York outside New York City on the new national program for Engineering Defense Training. Congress recently appropriated $9,000,000 for special engineering courses at the college level, to be given at government expense. The objective is to train 30,000 students with technical backgrounds to meet future needs of both industry and government in carrying out the defense program.

According to the statement from the Office of Education in Washington, "Courses of study will be given by the colleges both for those able to devote their entire time to preparation for future defense jobs and for workers now employed who desire to fit themselves for more responsible assignments. All instruction will be of college grade equivalent to that given regular candidates for a degree, but the special courses, which will require from two to eight months of study, will concentrate upon training of immediate practical application to specific defense jobs. Classes will be held both at the engineering schools and in or near industrial plants for the benefit of part-time and evening students. The regular college teaching staffs will be supplemented by additional teachers including specially qualified men from the industries to be served."

Dean Hollister for several weeks has been in constant touch with state schools involved: Clarkson College of Technology, Rensselaer Polytechnic Institute, Union College, Syracuse University, the University of Rochester and the New York State College of Ceramics at Alfred, in addition to Cornell University. In this program, he acts as a liaison officer maintaining continual contact with defense industries, Army and Navy district offices, employment services and other sources of information on personnel needs, as well as with local engineering schools equipped to meet demands for training courses as they arise. He is keeping the Washington headquarters continually informed so that deficiencies in any one region may be met, if necessary, by training students in other places where facilities are available.

A survey of the needs of industries in Southern Tier counties of New York State, where courses might be offered by Cornell University, has been made by the College of Engineering. Courses will be set up as rapidly as possible.

THE SCIENCE CARAVANS OF THE GENERAL MOTORS CORPORATION

ALFRED P. SLOAN, JR., chairman of General Motors Corporation, has announced the dedication of two science caravans "to the vital task of arousing the nation to the necessity of intensifying its research activities." He points out that "the hope of America, in time of emergency as in time of peace, lies in the retorts and test tubes of its laboratories." Both caravans will start within the next few weeks.

Mr. Sloan, in his announcement, writes:

> Our decision to send forth the "New Parade of Progress" and the "New Previews of Progress" to spread the gospel of research is, we are convinced, eminently sound. Only a cursory glance at what is taking place in the world to-day is needed to impress on one the importance of constant search for new products and processes.
>
> And new products and processes will be equally important to take up the slack of men, money and materials when our present emergency shall have ended. As a nation we should be spending ten—even one hundred times as much as we do for research.

The two General Motors shows, presented without charge to the public, will demonstrate not only what industrial research and engineering have accomplished, but also what may be expected from the laboratories of the future if America takes advantage of its opportunities.

The Parade of Progress will be presented out-of-doors, while the Previews of Progress is designed for indoor performances. Both will reproduce the highlights of the General Motors exhibits at the New York and San Francisco World's Fairs. They were designed and constructed under the general supervision of Dr. Charles F. Kettering, vice-president in charge of research, and will be sponsored by the Department of Public Relations, which is in charge of Vice-president Paul Garrett.

The Parade, with fifty young technicians, will go to the larger cities of the south; Previews of Progress, with a personnel of seven trained young men and de-

signed for performances in schools and halls, will go to the smaller cities in the west.

The Parade of Progress will travel in a caravan of twenty-two streamlined, silver-red "Futurliner" transports and tractor semi-trailer units. It includes a tent that will seat 1,500 persons, all with unobstructed views of the "science circus" stage. Colored fluorescent tubes will illuminate the interior; the exterior will be flood-lighted in color. It will include a small sample section of the General Motors Futurama, exhibited at the New York World's Fair; a diorama dramatizing improvements wrought in an American community by steadily bettered roads and vehicles; an exhibit contrasting past and future American home interiors; a series of dioramas picturing the small beginnings of great American industries; an outdoor stage demonstration of paradoxes of friction and of the elasticity of materials; a display of aviation progress; exhibits portraying progress in glass-making, coachcraft, gasoline and scientific automotive service. Some of these exhibits will be completely automatic in motion and sound; others will be in charge of demonstrator-commentators.

Light and power for the entire exposition will be supplied by a specially designed and constructed Diesel-electric plant, said by Mr. Kettering to be "one of the most complete mobile power plants in existence."

THE FORTIETH ANNIVERSARY OF THE RESEARCH LABORATORY OF THE GENERAL ELECTRIC COMPANY[1]

FORTY years ago E. Wilbur Rice, Jr., at that time vice-president of General Electric Company in charge of engineering and manufacturing, received a visit from two men, one an engineer and the other an attorney. They suggested the company should have a laboratory. There had been a problem in Mr. Rice's mind since Edison's famous lamp patent expired six years previously that something should be done to improve the lamp; but how to go about it had not been decided.

Perhaps here was the answer. So Mr. Rice listened as Albert G. Davis, then head of the patent department, and Dr. Charles P. Steinmetz explained their idea of a laboratory where scientific investigations might go forward on the incandescent lamp and other problems. "But these things can't go on without research," Mr. Davis declared.

Research! It was what Mr. Rice himself had been thinking of. Yet hardly another executive in the country in those days had considered such a step. In the discussion that followed all three men agreed that the laboratory should be entirely separate from the factory and sales branch of the company.

"The company spends thousands of dollars and its best brains in trying to add one half of one per cent. to the efficiency of the generator and transformer, yet this current so carefully generated, transformed and transmitted is sent into the lamp with an efficiency of something like five per cent. or less," Mr. Davis told Mr. Rice.

The ultimate result was that Mr. Rice's recommendation to the board of directors was approved without comment other than that Mr. Rice should exercise care in getting the right man to direct the laboratory. Dr. Willis R. Whitney, at that time a professor at Massachusetts Institute of Technology, was engaged. That was forty years ago, and on Tuesday, December 17, this notable anniversary was celebrated by General Electric, with a program beginning in the afternoon and culminating in the evening with a dinner at the Mohawk Golf Club. The speakers were Dr. Karl T. Compton, president of the Massachusetts Institute of Technology; Charles E. Wilson, president of General Electric, and Samuel Ferguson, president of the Hartford Electric Light Company, who was the first engineer of the General Electric laboratory, and Dr. Coolidge, vice-president of the company and director of the laboratory.

The laboratory had its beginning in Dr. Steinmetz's barn in the rear of his home in Schenectady. The house still stands, but the barn was burned soon after its use as a laboratory. Dr. Whitney came over three days a week to carry on experiments with Steinmetz and the "staff," which at that time consisted of one man, J. T. H. Dempster. After the fire, the laboratory was moved to a one-story frame building in the plant of the company which had been built two or three years earlier for a standardizing laboratory, but which had been discarded when this work was moved into a newer building. The structure was used until the spring floods in 1901 when the research laboratory was moved again, occupying the front part of the new standardizing laboratory. In 1904 it moved to a building of its own, adjoining, and later into its present home, two massive brick buildings.

From Dr. Steinmetz's barn to its present two large buildings in forty years—that is the story of the growth of research in General Electric Company.

THE NATIONAL DEFENSE RESEARCH COMMITTEE

ONE of the guiding principles of the National Defense Research Committee is to distribute the burden of research on problems of national defense in such a way as to cause the least possible interference with research already under way for the military services. With that in mind the committee has endeavored to arrange for research to be done wherever practical in institutions which had not already been engaged in research efforts connected with national defense. Obviously in the application of this principle care must

[1] A statement from The General Electric Company.

be taken that progress is not delayed. Where one organization is outstandingly qualified to conduct a particular piece of research, the problem is turned over to that organization even though it may have other defense research work under way. On the other hand, as between two or more organizations approximately equally well qualified to engage in a particular piece of research, preference is given to that organization which does not have other defense research activities under way.

Thus far, the National Defense Research Committee has authorized 126 separate contracts with a total of 51 different academic and industrial establishments. Of this total, 80 contracts are with 32 different academic institutions and 46 with 19 different industrial concerns.

The order establishing the National Defense Research Committee states that its purpose shall be to correlate and support scientific research on mechanisms and devices of warfare except those relating to problems of flight included in the field of activities of the National Advisory Committee for Aeronautics. It may conduct research for the creation and improvement of instrumentalities, methods and materials of warfare. The committee has recently adopted the following resolution as a general indication of the limits of its activity:

> The National Defense Research Committee, by reason of the order of the Council of National Defense which established it, is concerned with scientific research on and development of new instrumentalities or materials of war, or of new materials or methods to be used primarily in the manufacture of instruments of war; and of the improvement of existing instrumentalities or materials of war, or of existing material or methods to be used primarily in the manufacture of instruments of war. Where a material or method is widely used or useful in industry, in addition to its use in the manufacture of instruments of war, as for example in the case of substitute materials of wide utility, the research and development involved do not lie within the province of the National Defense Research Committee, but rather within the province of many existing industrial and scientific research agencies, and in particular, when appropriate requests for investigation or research in such fields are made by government agencies, within the province of the National Academy of Sciences and the National Research Council.

COMMITTEE ON FOOD AND NUTRITION OF THE NATIONAL RESEARCH COUNCIL

AT the request of Miss Harriet Elliott, head of the consumer division of the Advisory Commission to the Council of National Defense, the National Research Council of the National Academy of Sciences has organized a committee to promote the development and application of nutritional science. A national program for improving nutrition is in the planning stage under the immediate direction of Director M. L. Wilson, of the Extension Service of the Department of Agriculture, and in this program the Committee on Food and Nutrition of the National Research Council is expected to play an important part. The membership of the committee includes physicians, biochemists and representatives of home economics, dietetics, agriculture and industry. A group of consultants and representatives from governmental services with nutritional responsibilities are associated. It is anticipated that the work of the committee will have a bearing upon the national welfare not only for the time of the present emergency, but in later years as a continuing agency. The committee is organized under the Division of Biology and Agriculture, the Division of Medical Sciences and the Division of Anthropology and Psychology.

The membership of the committee is as follows:

Executive Committee: Russell M. Wilder, *Chairman;* Helen S. Mitchell, *Secretary;* George R. Cowgill; Icie Macy Hoobler.

Members: John N. Black, Henry Borsook, F. G. Boudreau, Joseph S. Davis, C. A. Elvehjem, Philip C. Jeans, Norman Jolliffe, C. G. King, James McLester, S. C. Prescott, Lydia J. Roberts, W. C. Rose, Cullen Thomas, R. R. Williams, John B. Youmans.

Government Representatives: Grace Bulman, William DeKleine, Martha M. Eliot, J. K. Fuller, Colonel Paul E. Howe, E. M. Nelson, W. H. Sebrell, Louise Stanley, Commander Charles S. Stevenson.

Consultants: E. V. McCollum, John R. Murlin, Mary Swartz Rose, H. G. Sherman.

Ex Officio: Robert F. Griggs, *Chairman,* Division of Biology and Agriculture; Lewis H. Weed, *Chairman,* Division of Medical Sciences; Carl E. Guthe, *Chairman,* Division of Anthropology and Psychology; M. L. Wilson, National Defense Nutrition Program.

SCIENTIFIC NOTES AND NEWS

DR. HARRY N. HOLMES, head of the department of chemistry at Oberlin College, Ohio, has been elected president of the American Chemical Society for 1942. Dr. Holmes will take office as president-elect on January 1 at which time Professor William Lloyd Evans, head of the department of chemistry at the Ohio State University, becomes president of the society, succeeding Dean Samuel Colville Lind, of the University of Minnesota.

AT a meeting in New York on December 20 of the fellows of the American Geographical Society, the

Cullum Geographical Medal was presented to Dr. Robert Cushman Murphy, curator of oceanic birds at the American Museum of Natural History; the Charles P. Daly Medal, "for valuable or distinguished geographical services or labors," was presented at the same time to Professor Carl Ortwin Sauer, head of the department of geography of the University of California in recognition of "his outstanding contributions to geography as a teacher and research scholar." The inscription on the medal to Dr. Murphy was "Robert Cushman Murphy—by following the sea birds to their haunts he has deepened our knowledge of the world of waters."

SIR ARTHUR KEITH, master of Buckston Brown Research Farm at Downe, anatomist and anthropologist, was elected an honorary member of the New York Academy of Sciences at the annual meeting of the academy, held in New York on December 11.

DR. FRED H. ALBEE, president of the International College of Surgeons, formerly professor of orthopedic surgery at the New York Postgraduate Medical School, received a bronze plaque designating him "the Man of the Year" for 1940 from the Greek letter fraternity, Kappa Sigma, at the annual Founders Day banquet held in Washington on December 10. The award was made in recognition of his achievements on bone graft surgery and in rehabilitation work.

W. D. COOLIDGE and Stuart M. Crocker have been appointed vice-presidents of the General Electric Company. Dr. Coolidge will continue as director of the research laboratory in Schenectady. Mr. Crocker will relinquish his work as manager of the department of air-conditioning and commercial refrigeration of the company at Bloomfield, N. J., and will make his headquarters in New York City, where he will cooperate with and be assisted by all commercial departments in furthering the general interests of the company.

THE Scientific Society of San Antonio, Texas, at its thirty-sixth annual meeting, elected as president Colonel W. Lee Hart, Medical Corps, United States Army, now serving as chief surgeon of the Eighth Corps Area.

THE Detroit Academy of Natural Sciences has elected the following officers for 1941: *President,* Robert T. Hatt; *Vice-president,* Bert Hudgins; *Secretary,* Bert Lambert; *Treasurer,* Fred Robinson; *Member of the Council,* George Rawson.

OFFICERS for the coming year of the Botanical Society of Washington have been elected as follows: *President,* J. E. McMurtrey, Jr.; *Vice-president,* Victor F. Tapke; *Recording Secretary,* L. Edwin Yocum; *Corresponding Secretary,* Marguerite S. Wilcox; *Treasurer,* Harvey L. Westover; *Counsellors,* John R. Magness, Earl S. Johnston; *Representative to the Washington Academy of Sciences,* Melvin C. Merrill.

THE board of governors of the Society of the New York Hospital has elected William Harding Jackson, member of the law firm of Carter, Ledyard and Milburn, president of the society. He succeeds Berklie Henry, president for the past two years, who was elected vice-president. Augustine J. Smith, senior member of the board and a governor for thirty-eight years, was reelected secretary. Henry S. Sturgis, vice-president of the First National Bank, was reelected treasurer.

HOWARD R. BARLOW, associate professor of aeronautical engineering, of the University of Minnesota, who has been acting head of the department this summer during the absence of Professor John D. Akerman, has been made head of a new department of aeronautical engineering at the Texas Agricultural and Mechanical College Station.

BURGESS H. JENNINGS, of Lehigh University, has been appointed professor of mechanical engineering at Northwestern University; Carl C. Branson has been appointed visiting assistant professor of geology and geography.

DR. MICHAEL PEECH, chemist at the Florida Citrus Experiment Station, has been appointed assistant professor of agronomy in the New York State College of Agriculture of Cornell University to fill the position held by Professor Benjamin D. Wilson, who died on September 5 of injuries suffered in an automobile accident.

DR. ROBERT D. DEFRIES has been appointed director of the School of Hygiene and of the Connaught Laboratories of the University of Toronto. During the past twenty-five years he has been engaged in the work of these two institutes, having early in 1915 become actively associated with the late Dr. J. G. FitzGerald, whom he now succeeds.

DR. MAX TRUMPER, chief of the department of biochemistry and toxicology of St. Luke's and the Children's Hospital, Philadelphia, has been elected a member of the Board of Trustees of the National Farm School at Doylestown, Pa.

ACCORDING to *Nature* the following appointments have recently been made in the British Colonial Service. P. R. Akehurst, agricultural officer, Nyasaland; L. H. Browne, agricultural officer, Nigeria; J. W. D. Goodban, agricultural officer, Nigeria; A. P. MacWilliam, agricultural officer, Trinidad; D. B. Murray, agricultural officer, Nigeria; P. Paine, agricultural

officer, Nigeria; M. F. H. Selby, botanist, Nigeria; N. Harris, geologist, Uganda.

DR. HENRY K. SVENSON, curator of the herbarium at the Brooklyn Botanic Garden, sailed for Ecuador on December 20. The recipient of a fellowship from the Guggenheim Foundation, Dr. Svenson plans to study the plants on the coast of Ecuador and determine what relation they may have to the plants of the Galapagos Islands. He expects to be absent for about four months.

DR. CORNELIUS P. RHOADS, director of the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York, has been appointed a member of the National Advisory Cancer Council for a term of three years. The council cooperates with the federal government in the treatment of cancer throughout the country and in research and education to combat the disease.

DR. ERHARD FERNHOLZ, chief of the Division of Chemistry at the Squibb Institute for Medical Research at New Brunswick, N. J., disappeared on December 14. It is reported in the press that the Federal Bureau of Investigation has not been able to find any clue.

DR. E. A. DOISY, professor of biological chemistry and director of the department of chemistry at the School of Medicine of St. Louis University, has presented the first lecture under the Julius Stieglitz Memorial Lectureship at the University of Chicago. The lectureship was established through joint effort of the Chicago Section of the American Chemical Society and alumni of the department of chemistry of the University of Chicago.

DR. LANCELOT HOGBEN, of the University of Aberdeen, at present guest professor of genetics at the University of Wisconsin, spoke at the Iowa State College on December 13 on "Recent Developments in the Evolutionary Theory" and on "Methods and Problems of Human Genetics." The latter lecture was given at a meeting of Sigma Xi.

DR. ISAAC STARR, Hartzell professor of research therapeutics at the University of Pennsylvania, gave on November 13 the fourth annual Paul Reed Rockwood Lecture of the College of Medicine of the Iowa State University. His subject was "The Ballistocardiogram; Its Contribution to Our Knowledge of the Commoner Diseases Affecting the Heart and Circulation."

DR. FRANK H. LAHEY, director of surgery at the Lahey Clinic, Boston, president-elect of the American Medical Association, formerly professor of surgery at the Medical School of Tufts College, delivered the second Floyd Wilcox McRae Memorial Lecture on December 16, before the Fulton County Medical Society, Atlanta. His subject was "The Management of Gastric, Duodenal and Jejunal Lesions."

J. D. BERNAL, associate director of research in crystallography at the University of Cambridge, gave an address on "The Physics of Air-raids" at the Royal Institution, London, on December 3.

THE American Mathematical Society is endeavoring to increase interest in questions of the application of mathematics by special lectures and symposia designed for engineers and applied mathematicians and intended to call the attention of pure mathematicians to problems in the applied field. As the initial lecture in this connection, it is planned to have Dr. C. Rossby, of the U. S. Weather Bureau, speak at the joint meeting of the society and the American Association for the Advancement of Science in Philadelphia at Christmas time. His subject will be "The Mathematical Problems in Meteorology." At the February meeting of the society, it is planned to devote Friday afternoon to applied mathematics. First, there will be talks by Dr. W. A. Shewhart, of the Bell Telephone Laboratories, on "Statistics" and by Professor J. J. Stoker, of New York University, on "The Mathematical Problems Connected with the Buckling of Elastic Plates." Further lectures of this type are planned for future meetings.

THE Hoffmann Scholarship of the Chemists' Club, established by the late Dr. William F. Hoffmann, will be available for the school year 1941–42. Candidates are limited to men entering the last year of post-graduate work leading to the Ph.D. degree in chemistry or in chemical engineering in an institution of recognized standing. Applications will be considered after January 1, but will not be accepted after April 15. Harvey H. Grice, a candidate for the Ph.D. degree in chemical engineering at the Ohio State University, has been awarded the Bloede Scholarship of the club for the school year 1940–41. This scholarship, which was founded in 1916 by the late Dr. Victor G. Bloede, was originally given every year. Appointments are now to be made in alternate years; the stipend is $580.

Two graduate fellowships in chemistry have been established at the University of Buffalo by the Buffalo Electro-Chemical Company. The fellowships will provide the holders with $1,000 each for the academic year. During his tenure each fellow will be engaged in research work under the supervision of the department of chemistry and will be a candidate for the degree of doctor of philosophy.

THE Iowa State College has received a farm and a gift of $10,000 from Rollins E. Hinds, of Ottumwa. On accepting the gift, the Board of Education estab-

lished the Hinds Fund for Agricultural Research. This fund will be used, in cooperation with the Soil Conservation Service, for the study of soil erosion.

THE California Commission, a body created by the governor of the state to aid the recent Golden Gate Exposition, has presented exhibits valued at $80,000 to the University of California. Among exhibits sent to other institutions, two went to the Buffalo Museum of Science in Buffalo, N. Y. These were the Demonstration of Human Heredity and the Migration of the Races of Man. The Museum of Science and Industry in Chicago received the model of the San Francisco-Oakland Bay Bridge. The Griffith Observatory, a part of the Los Angeles City Park System, received the exhibit on Nuclear Charge, otherwise known as the Soap Bubble Gun, and Stanford University acquired the exhibit of the Embryology of the Salamander, which was prepared in cooperation with Dr. V. C. Twitty, of that university.

IN an article in *Industrial Standardization* R. P. Anderson, chairman of the American Standards Association, states that despite the war situation in Europe, the American Standards Association has continued its support of the International Electrotechnical Commission and also of the International Standards Association. While much of the international work is at a standstill and the future situation is uncertain, it is maintaining contacts with a number of foreign standardizing bodies and continuing to obtain copies of their standards wherever possible. So far, the association has encountered no great difficulty in sending and receiving communications from these groups abroad and its file of foreign standards has been invaluable to American firms filling orders for export. Even the British Purchasing Commission has found it necessary to call on the association on numerous occasions for standards and specifications which they did not have themselves. Recently the American Standards Association has received copies of the second edition of the International Electrotechnical Vocabulary, which is being distributed in the United States.

DISCUSSION

PERCEPTUAL DISORIENTATION DURING LANDING OF AIRPLANE

UNDER the above title in SCIENCE, November 22, A. D. Moore described an illusion which he had noted during landings of airliners, and he raised a question on the possibility of trouble in case a pilot was confronted with unusual conditions that might make him subject to this illusion. Writing partly as a pilot with a thousand-and-some hours, but more as a physicist, I feel sure the illusion will not cause any such trouble, but I should like to add a point to Moore's explanation.

Briefly, the illusion is this: Looking across the ship from a seat in the passengers' cabin, when the ship had "started to skim along the runway," the field "appeared to slope down forward at an angle of about 15 degrees." This illusion continued after the wheels touched the ground, even though Moore turned his head repeatedly between that window and one on his own side, through which the ground "remained horizontal." But, "when the plane, with a low remaining speed, wheeled through a short turn to taxi back, the phenomenon abruptly ceased."

In explanation, Moore notes that during each flight before such an observation he had got accustomed to the fact that the window frame lines were horizontal and vertical, so it was natural to persist in thinking of the horizontal ones as horizontal even when the ground seen through the frames was no longer parallel to them. This is indeed natural, as I can testify in terms of a memory from age 10 or 12, of exploring the hold of a schooner, which had been wrecked on a beach and lay heeled over some 10 or 20 degrees, and feeling seasick, apparently because of the conflict of such evidence with that of my semicircular canals and other internal senses.

There is more to it, however, in my opinion. Airline pilots use their controls and throttles with most expert smoothness. In their hands the ship changes its attitude and its speed with none of the bumps of a railroad train or an automobile. And the cruising speed is so high that in stopping the ship with a backward acceleration of the order of 20 per cent. of gravity there is time to build up this acceleration very gradually and then maintain it for a long time.

Let us apply these principles to the approach and landing. In the straight glide, for perhaps a mile or two, the ship is nosed down and the passenger gets used to the downward slope of the floor and of the "horizontal" frame lines of the windows. The speed is almost constant, the propeller thrust and the forward component of gravity being balanced by the drags of the ship and its flaps, which are usually down for most of this time. Nearing the airport boundary the throttles are closed smoothly, reducing the propeller thrust to zero and thereby introducing a considerable backward acceleration. But during this change the nose is rising and the flight path is becoming more level. So, as the backward acceleration grows, the forward component of gravity fades out. The passenger, however, so long as he keeps his eyes within the ship, has no way to tell backward acceleration from forward gravity. If the changes are smooth enough, and properly correlated as to time and magnitudes,

his visual illusion of the cabin as a fixed frame of reference may be corroborated by false evidence from his semicircular canals and all other physiological means of sensing what is horizontal. With all these senses combining to mislead him, it is no wonder that he may discredit the little glimpses of the ground through these small and distant and apparently stationary windows.

After the wheels touch, the aerodynamic drags weaken gradually, but the wheel brakes take their place and the backward acceleration may not change much. So it is reasonable that the illusion should persist sometimes nearly to the end of the run. Then, when the ship wheels around and the engines start up for taxying, the acceleration is quickly changed from backward to forward; so in the cases observed by Moore, "the phenomenon abruptly ceased."

To create this illusion, and to maintain it during the change from aerodynamic drags to wheel brakes, the ship must indeed have to be handled very smoothly. But these airline pilots are smooth!

On the practical question of the possibility of a pilot being misled by this illusion, it must be noted that experienced pilots are already disillusioned as to their sense of level, and they are also well trained on how the ground should look in a landing.

This does not mean any lack of use for the sense of level, but only that its use is not what the layman would expect. The principles applied above, to explain Moore's phenomenon, apply also to turns. In them, centripetal acceleration acts like the backward acceleration in a landing, to mislead our sense of level. The only difference is that in the turn it is not through the side windows, but ahead, that the horizon appears not horizontal. If the ship is correctly banked for the turn, however, she seems level to all senses but that of sight. So the pilot uses his internal senses of level to find the correct angle of bank, well knowing that what he senses is not really level, and he uses his eyes to find the true level.

This separation of the internal and visual senses of level, and their concurrent but independent uses for different purposes, is therefore a very important part of piloting. The ability to separate them has to be acquired in learning to fly, because flight is the only activity in which accelerations can grow so smoothly and with so little angular velocity as not to warn us of the difference between acceleration and gravity. Having acquired this ability, however, and having had to put some real effort into its acquisition, the experienced pilot can be counted on to apply it in landing on any airport that he can see. So there is no appreciable chance of his being misled by Moore's illusion.

DAVID L. WEBSTER

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SPATIAL DISORIENTATION DURING LANDING FROM AIRPLANE

THE type of spatial disorientation reported by Professor A. D. Moore[1] in connection with the landing of an airplane is by no means unknown to experimental psychologists, although too little attention has been paid to it in the literature on space-perception. The basic principle, as Professor Moore suggests, is that of the conflict of two spatial frames of reference, both of which reside in the visual field of the observer, but one of which is more closely related to the directional system of the observer's body. The ground, as seen through the near window, occupies a sufficiently large visual angle to dominate the perceptual process and consequently to provide a "true" system of horizontal and vertical directions. As seen through the far window it is imbedded in the framework of the interior of the plane, and is consequently seen as tilted. The underlying principles have been discussed, although with different examples, by Koffka,[2] Wertheimer[3] and others, and the phenomenon has even crept into at least one elementary text-book.[4]

Whether or not this is a newly discovered phenomenon is, however, of no importance. What is to be emphasized is that this type of "illusion," and the underlying psychological principles, may too easily be overlooked, not only in aviation but in any field of activity in which the perception of space is an important factor. In seeking for the determinants of our perception of spatial directions we are apt to concentrate on the vestibular functions to the neglect of visual organization. In the example which Professor Moore cites, the problem is essentially visual. I am inclined to think that the solution which he proposes will not prove satisfactory. It might be noted, however, that a sub-committee on problems of perception has recently been organized in connection with the program of the National Defense Research Committee. The problem might well be referred to this committee.

R. B. MACLEOD

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THE HEAT OF SEROLOGICAL REACTIONS

THE only attempt to measure directly the heat of an antibody-antigen reaction known to us is that of Bayne-Jones.[1] It is generally admitted that his result is much too high.[2] We have recently completed mea-

[1] A. D. Moore, SCIENCE, 92: 477, 1940.
[2] K. Koffka, "Principles of Gestalt Psychology," 1935.
[3] M. Wertheimer, *Zsch. f. Psychol.*, 61: 161–265, 1912.
[4] E. G. Boring, H. S. Langfeld, H. P. Weld, "Introduction to Psychology," 1939.
[1] S. Bayne-Jones, *Jour. Immunol.*, 10: 663, 1925.
[2] F. C. Smith and J. Marrack, *Brit. Jour. Exp. Path.*, 11: 494, 1930.

surements of the heat evolved when an antigen (hemocyanin of *Busycon canaliculatum*) reacts with an immune serum containing the corresponding antibody. In the region of antibody excess, where no precipitate is formed, a value of about 3.0 calories per gram of antigen nitrogen was found (measured at 31° C.). Since the molecular weight of the antigen is 6,800,000, this corresponds to about 3,300,000 calories per mol of antigen. It is believed that this value is probably accurate to about 20 per cent. By extrapolation from analyses of specific precipitates, it was calculated that the above result corresponds to about 40,000 calories per mol of antibody. The magnitude of the result would presumably be different when the antibody and antigen were mixed in different proportions, and would probably be different for antigens of different molecular weights, on account of the different numbers of specific combining groups. Details will be published elsewhere.

WILLIAM C. BOYD

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LINNAEUS ON MAN'S NATURAL HISTORY

I HAVE just received, from Miss R. E. Dosé, from the Department of Agriculture, dated October 23, 1940, the note given below, which may be of general interest. It is an extract from a book containing correspondence of John George Gmelin with Carl Linnaeus and others, edited by Dr. William Henry Theodore Plieninger, and published at the order and expense of the Royal Academy of Sciences of St. Petersburg, Stuttgart, 1861.

On page 55 of this book there is a letter written by Linnaeus to Gmelin from Upsala on February 14, 1747. Here is a translation of a part of this letter:

> It would not please, if I placed the man among the anthropomorphous; but man knows himself. Let us abandon words, I do not care what words we use; but from thee, and from the whole world I want an answer to this: What is the difference between man and ape, difference which would be based on natural history? Most definitely I see no difference. I wish some one could show me even one distinction! Should I call a man "ape" or an ape "man," all the theologians would be after me. Yet, for the sake of science, I should have done it.

ALEŠ HRDLIČKA

U. S. NATIONAL MUSEUM

RESIGNATION OR EQUANIMITY?

THE system of weights shared by the English-speaking world is often regarded as a cross to be borne with resignation. In our opinion it should be borne with cheerful equanimity: its minutiae test the memory and sharpen the wit. The table we have prepared may be useful to the student of science who is trained to think in terms of the metric system within the laboratory and in the English system elsewhere. Though not very useful to foreign students visiting our laboratory, this table at least entertains them. They are presented with a copy but are not asked to memorize it.

ORDINARY SYSTEM OF WEIGHTS

	1 grain (pearls)	50 mg.
1.296 grains (pearls)	= 1 grain (ordinary)	64.8 mg.
3.086 grains (ordinary)	= 1 carat (m.)	200 mg.
1.027 carats	= 1 carat (1877)	205.6 mg.
6.30 carats (1877)	= 1 scruple (apothecary)	1.296 g.
1.200 scruples (apoth.)	= 1 pennyweight (Troy)	1.355 g.
1.140 pennyweights (Troy)	= 1 dram (avoirdupois)	1.772 g.
2.194 drams (av.)	= 1 dram (apothecary)	3.888 g.
7.29 drams (apoth.)	= 1 ounce (av.)	28.350 g.
1.097 ounces (av.)	= 1 ounce (Troy & apoth.)	31.103 g.
12.00 ounces (Troy & apoth.)	= 1 pound (Troy & apoth.)	373.241 g.
1.215 pounds (Troy & apoth.)	= 1 pound (avoirdupois)	453.59 g.
14.00 pounds (av.)	= 1 stone	6.350 kg.
2.00 stones	= 1 quarter	12.701 kg.
2.68 quarters	= 1 flask (mercury)	34.019 kg.
1.333 flasks (Hg)	= 1 keg (nails)	45.359 kg.
1.00 keg (nails)	= 1 short hundredweight	45.359 kg.
1.120 short hundredweight	= 1 long hundredweight	50.802 kg.
1.607 long hundred weight	= 1 small barrel (lime)	81.65 kg.
1.089 small barrels (lime)	= 1 barrel (flour)	88.90 kg.
1.020 barrels (flour)	= 1 barrel (fish)	90.72 kg.
1.400 barrels (fish)	= 1 large barrel (lime)	127.00 kg.
3.571 large barrels (lime)	= 1 kip	453.59 kg.
2.00 kips	= 1 short ton	907.00 kg.
1.120 short tons	= 1 long ton	1016.04 kg.

Inspection shows that with few exceptions the definers of our units have successfully avoided the monotonous uniformity of the metric system by allotting no more than an equitable share of zeroes to the ratios between successive units. In order to bring into line the few exceptions which did slip by we suggest that the simple change of redefining a stone as 13 5/7ths pounds instead of 14 would make the stones and quarters accord more closely with the rest of the system, leaving only the ounces, the keg and the kip to be dealt with.

W. H. FORBES
D. B. DILL

HARVARD UNIVERSITY

SCIENTIFIC BOOKS

LATTICE THEORY

Lattice Theory. Vol. XXV. Colloquium Publications. By GARRETT BIRKHOFF. v+155 pp. New York: American Mathematical Society. 1940.

THE past decade has seen a tremendous and continuing growth of interest in modern abstract algebra. Algebraic concepts and technique have been found to be frequently applicable to other branches of mathematics as well as other sciences, and their fundamental value has been emphasized thereby.

A major portion of algebraic study has been concerned with mathematical systems consisting of a set of elements which behave with respect to two operations very much as ordinary numbers do with respect to addition and multiplication. In studying subsystems of the same type as a given system one usually considers the meet and join of any two of them, and finds that these are again subsystems of the same abstract type. Thus one may again abstract and study a new type of mathematical system consisting of two operations and a set of elements whose behavior with respect to the operations is now like those of subsystems with respect to meet and join. The application of algebraic research technique to this most recent phase of abstract algebra is a study which has strongly attracted many American algebraists and one of the most prolific workers in the field is Garrett Birkhoff, who has called the subject *Lattice Theory.*

Birkhoff's book is the first comprehensive treatment of the subject and its applications. It contains all the recent major developments in the subject in a unified form which will make the book an inspiring research reference for the relatively large number of research algebraists interested in the field. The exposition is clear and well written and should prove of great value in satisfying the demand of non-specialists in the subject who have been anxious for several years to obtain a text by the use of which it may be possible to present the subject as a graduate course in modern mathematics.

ADRIAN ALBERT

THE UNIVERSITY OF CHICAGO

FORAMINIFERA

A Catalogue of Foraminifera. By BROOKS F. ELLIS and ANGELINA R. MESSINA. 30,000 pp. The American Museum of Natural History. $100.00.

THE natural sciences have reached a stage in their development where the scientist is almost buried under the knowledge with which he has to deal. No longer can he make this knowledge usable by merely organizing it. He must now summarize it and catalogue it as well.

The summarizing and cataloguing of man's knowledge of even a relatively small branch of one of the natural sciences, such as a single group of animals, is a laborious task. When the group contains more than 18,000 species the task calls not only for much labor, but for great organizing ability on the part of the scientist and large-scale financial backing by some interested institution or government bureau. Few scientists have had the ambition to plan summaries or catalogues of this scope, fewer still have had the courage and energy to undertake their preparation, and very few, indeed, have had the ability to enlist the necessary financial support and carry the work through to completion. This catalogue is proof, however, that, given the man, such projects can be successfully carried out.

Because of their importance as index fossils in the search for petroleum and for other reasons the Foraminifera have received a good deal of attention from biologists and paleontologists in recent years. Much has been published concerning them in many languages. Some 18,000 living and extinct species have been described. The mere cataloguing of these species must have been a huge undertaking. The preparation of an *illustrated* catalogue was a task on which only a brave and optimistic man would have dared to venture. That Professor Ellis *did* undertake it is proof that he was both courageous and an optimist. That he completed it is proof that he was a practical idealist.

Undoubtedly the most practical thing which Professor Ellis did when he planned this project some ten years ago was to enlist the cooperation of Miss Messina, who shares with him the credit for its successful carrying through. With the generous assistance of the Work Projects Administration, the American Museum of Natural History, Columbia University and New York University, these authors have prepared and issued one of the most voluminous single publications relating to the natural sciences that has ever appeared in print. A staff of 125 artists, bibliographers, editors and other assistants was engaged for six years in the preparation of the manuscript and its printing.

The 30,000 pages of the catalogue contain one or more figures of every species of foraminiferan, living or extinct, a reference to the original description of the species, a transcript of the original description, a record of the time range, type locality and geographic range of each species, the depository of the type specimens and a list of bibliographic references. There are also included a discussion and bibliography of each genus, with a type reference, a transcript of the original description and the name of the genotype when a genotype was designated by the original author. The pages of the catalogue are bound in ledger type post binders to permit future rearrangement and the insertion of additional pages containing descriptions of new

genera and species which will be issued by the Department of Micropaleontology of the American Museum of Natural History.

The books are printed on sturdy paper. Their pages will need to be strong if they are to withstand the constant wear which such indispensable reference volumes are sure to receive at the hands of biologists and paleontologists for many years to come.

B. F. HOWELL

PRINCETON UNIVERSITY

SOCIETIES AND MEETINGS

THE TEXAS ACADEMY OF SCIENCE

ON Saturday, November 9, the Texas Academy of Science closed its three-day annual meeting held at the Plaza Hotel, San Antonio. The Texas Federation of Nature Clubs (Dr. Leo T. Murray, of Baylor University, *president*) and the Texas Wildlife Federation (Dr. Walter P. Taylor, of A. and M. College, regional representative, *chairman*) were cooperating organizations. The meetings included fifteen technical sessions, two public general sessions, three business sessions, six luncheons and special dinners and the annual dinner beside the business, technical and social sessions of the Collegiate and Junior Divisions of the Academy. An estimation of attendance places the number of separate individuals who were present at one time or another at well over one thousand.

Speakers following the Thursday dinner were: Colonel H. A. Finch, U. S. A., on the "Science of National Defense," and Dr. Robert Montgomery, of the University of Texas, on "The Effect of Monopolies on Our National Defense Program."

Following the Friday dinner Dean Oscar A. Ullrich, of Southwestern University, president of the academy, presented his presidential address, "The Adolescence of Social Science." He was followed by L. B. Kingman, of the Federal Bureau of Investigation, who spoke on "The Science of Crime Detection."

The Collegiate division of the academy, which consists of student chapters in the various colleges of the state, held three scientific, a business and a luncheon session during Friday and Saturday. About 100 division members attended.

The Junior division, consisting of high-school chapters throughout the state, presents its main program at the regional spring meetings. This is necessitated by the large area of the state. At the annual meeting only officers' conferences, prize and outstanding papers sent in from the preceding regional meetings, and local papers participate. However, twenty-three papers and a division breakfast appeared on the program.

Local colleges, museums and learned societies of San Antonio all participated in forwarding the plans for the meeting and in contributing to success.

There developed a strong movement, in the interests of forwarding some special plans to be announced definitely later, for maintaining a continuity of 1940 plans through 1941, and Drs. O. A. Ullrich, of Southwestern University, Frederick A. Burt, of A. and M. College, Otto O. Watts, of Hardin-Simmons University, and S. W. Bilsing, of A. and M., who served respectively as president, secretary, treasurer, and representative to the council of the A. A. A. S., will continue in their offices until the time of the next annual meeting. Over 100 new members were elected to membership, and 29 members of one or more years standing were by vote transferred to the list of fellows.

FREDERICK A. BURT,
Secretary

REPORTS

DEFERMENT FROM MILITARY SERVICE OF SCIENTIFIC MEN

THE question of deferment from military service of selected men in six scientific fields in industry and educational institutions is the subject of a report in answer to a request of Clarence A. Dykstra, director of the Selective Service System. It is signed by Dr. Isaiah Bowman, president of the Johns Hopkins University, and Dr. Frank B. Jewett, president of the National Academy of Sciences. The report was prepared under the auspices of the National Academy of Sciences and the Subcommittee on Military Affairs of the National Committee on Education and Defense, created jointly by the American Council on Education and the National Education Association.

The report follows:

Both because your letter asks for a prompt reply and because the entire structure of the defense program is not yet sufficiently developed to indicate the full extent to which scientific personnel should be exempted temporarily or permanently from military service, it is impossible at this time to express an opinion as to the whole field of fundamental and applied science.

All that this statement attempts to do therefore is to cover those fields of science in which the conditions seem clearly to indicate the general course that should be pursued in the best interests of the national defense program. As to the other fields of science, supplementary statements may be issued as soon as they can be more thoroughly studied from the standpoint of general procedure. Individual cases for deferment un-

doubtedly exist in all of them at the present time and more will develop as the defense program expands.

Experience of every nation engaged in the World War and the conditions under which the present conflict in Europe is being waged point directly to the necessity for proper employment of scientific personnel and of those competent to train such personnel, to a continuous supply of newly trained personnel, and to the penalties incident to assigning them in large numbers to purely military service where others without their special training can function equally well.

At the moment, the fields of science in which the present and prospective personnel situation in relation to the needs of the defense program clearly require careful consideration of requests for deferment by both university presidents and heads of industrial laboratories are as follows:

Medicine, dentistry and pharmacy.

Biology, bacteriology and any other branch of biological science which bears directly upon problems of medicine or the public health, safety or interest.

Chemistry.

Physics.

Geology and geophysics, including such specialized fields as meteorology, hydrology and cartography.

Engineering, including civil, electrical, chemical, mechanical, agricultural, sanitary and mining.

You request advice which will be of assistance both to university presidents and heads of industrial laboratories. Their problems of deferment are similar although not identical. The college and university is concerned both with the training of men and in the conduct of fundamental research. The industrial laboratory is concerned primarily only with the conduct of research.

So far as college and university presidents alone are concerned, questions of deferment of both students and faculty are involved in all six fields.

In the training function, the institutions vary as to the extent of specialization in the areas above. Recommendations for deferment should be made for students only in those fields in which the institution is adequately equipped both in personnel and facilities to provide an adequate and comprehensive educational program.

Until July 1, 1941, the situation as to students in science, both undergraduate and graduate, appears to present no immediate problem in view of (4f) of "Selective Training and Service Act of 1940." If further deferment beyond July 1, 1941, for students (particularly graduate) is made possible it may present no special problem.

An exception requiring immediate determination for permanent exemption of students from military field service until after graduation may exist in certain fields, *e.g.*, medicine, dentistry and pharmacy, where there will be large demand for trained men in both the military and civil sectors, and where, because of the character of the training required, a deficiency of supply of qualified personnel can not be made up by intensive specialized training.

Deferment should be requested for advanced undergraduate and graduate students who, in the judgment of the college and university administrators, will be specially qualified to contribute to the defense program if permitted to complete all or a major part of their study before entering the military establishment or a defense industry, or who are required to replenish a depleted instructional staff. Such requests should be on an individual basis and only for those in good standing, majoring in the respective field, and who have completed at least two years of college.

In all six fields university presidents should request deferment of members of the teaching staff who in their judgment are essential properly to maintain the efficiency of the institution in the continuous training of students necessary in the operation of the defense program or in the effective conduct of research and development problems assigned to the institution in connection therewith.

The industrial laboratory and some graduate schools employ trained personnel often in group or team operations which require not only highly skilled individual scientists and engineers but likewise men accustomed to working together in close cooperation. Subtraction of a single key man from such a group may seriously handicap or even substantially destroy the efficiency of the group to function.

The problem of the industrial and university research laboratory concerned with a present or prospective defense program is not only one of retaining an adequate number of highly trained research men, engineers and skilled technicians but also one of maintaining the integrity of research and development teams. This is because industrial research and development is a coordinated group activity.

Research directors should request deferment of highly qualified men whose training and experience are such that their withdrawal will cripple the ability of the laboratory to function effectively in the defense program.

In addition to trained scientists and engineers, the industrial and university laboratory is largely dependent on skilled craftsmen, such as draftsmen, instrument makers, etc. Request for deferment of skilled men in these categories is indicated unless they can be replaced.

FOR THE NATIONAL ACADEMY OF SCIENCES,
FRANK B. JEWETT, *President*
FOR THE SUBCOMMITTEE ON MILITARY AFFAIRS,
ISAIAH BOWMAN, *Chairman*

SPECIAL ARTICLES

A FURTHER NOTE ON THE IDENTITY OF VITAMIN H WITH BIOTIN[1, 2]

IN a previous communication[3] we reported that a preparation of crystalline biotin methyl ester possessed vitamin H activity to a very high degree. This observation provided additional and direct support for our earlier conclusion[4] that vitamin H and biotin are "either identical or indeed closely related compounds." The sample employed in the investigation[3] was a solution of 150 γ of crystalline biotin methyl ester in ethyl alcohol that had been kindly furnished us by Professor F. Kögl. This material, which had been isolated from egg yolk, was shown by our assays with the rat curative method to contain 10,000 vitamin H units per mg. We now wish to report confirmation of the vitamin H activity of biotin by assays of crystalline biotin methyl ester isolated by us from a liver concentrate.

The first crystalline product we obtained from the liver concentrate possessed the same crystalline form as reported by Kögl and Tönnis[5] but showed a slightly higher melting point of 154° in contrast to that of 148° reported by them. It also showed a somewhat higher biotin activity (about 20 per cent.) when assayed against the sample furnished us by Kögl. The vitamin H assays, likewise, were proportionately higher. In view of this somewhat higher melting point and activity, we became interested in determining whether further purification were possible.

By repeated crystallization of the compound from a mixture of methanol and ether, a product of constant melting point and biotin activity was obtained which melted sharply in the Kofler micro-melting point apparatus at 166–167° (uncorrected), a melting point 18–19° higher than that reported by Kögl and Tönnis. The compound crystallized in long thin plate-like crystals from the methanol-ether mixture but crystallized in needles from chloroform by the addition of petroleum ether as described by Kögl and Tönnis. A full presentation of the chemical and physical properties of the compound will appear elsewhere. The biological activity and melting point of the pure biotin methyl ester were confirmed by several separate isolations. Furthermore, sublimation *in vacuo* followed by crystallization from a mixture of methanol and ether did not change the melting point, crystalline form or biological activity.

Using the yeast growth method,[6] we have compared the biotin activity of our purified crystalline material with the biotin activity of the vitamin H preparation (34 vitamin H units per mg) that we had used as an arbitrary standard in our previous communication.[3] *Expressed in terms of vitamin H units,* the various preparations of purified product that we have made have all consistently yielded, in the yeast growth method, the high value of 27,000 (± 10 per cent.) vitamin H units per mg. Direct vitamin H assays of our crystals, made on rats by the curative method, are in agreement with this high potency.

It may be added that Professor Dean Burk, using *Rhizobium trifolii* Strain 209, has found that our crystals possess "coenzyme R activity" of maximum observed potency, half-maximum growth being obtained at about 0.00001 γ per cc of growth medium and 95–100 per cent. maximum growth at 0.0001 γ per cc. This confirms, with strictly pure biotin ester, the conclusion of Nilsson, Bjälfve and Burström,[7] and of West and Wilson[8] that coenzyme R and biotin are identical. Our crystalline biotin ester was also found to be effective in promoting the growth of *Clostridium butylicum* Strain 21, by Dr. D. W. Woolley, of the Rockefeller Institute for Medical Research. Dr. Woolley's quantitative comparison of this crystalline material with Kögl's sample, made by assay with this organism, confirmed the ratio of potencies given above.

In conclusion we may state that the crystalline biotin ester prepared by us, purified to constant melting point and constant biotin activity, possesses such an extremely potent vitamin H activity—far beyond any previously known degree of activity—as to leave no doubt that vitamin H and biotin are one and the same compound. The behavior of the material in our hands has convinced us that we are dealing with an individual compound possessing the several biological activities mentioned in this note.

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CATHARINE S. ROSE
THE BABIES AND CHILDRENS HOSPITAL, AND
DEPARTMENT OF PEDIATRICS, SCHOOL OF MEDICINE,
WESTERN RESERVE UNIVERSITY, CLEVELAND
KLAUS HOFMANN[9]
DONALD B. MELVILLE[10]
VINCENT DU VIGNEAUD
DEPARTMENT OF BIOCHEMISTRY,
CORNELL UNIVERSITY MEDICAL COLLEGE, N. Y.

[1] In this cooperative research reported here, the Cornell group has been responsible for the chemical work and for the biotin assays, and the Western Reserve group for the vitamin H assays.

[2] The authors would like to express their appreciation to W. O. Frohring, president of the S.M.A. Corporation, for his interest and genuine cooperation and to the research staff of the S.M.A. Corporation and Miss Eleanor Hague for technical assistance in the biotin assays.

[3] V. du Vigneaud, D. B. Melville, P. György, C. Rose, SCIENCE, 92: 62, 1940.

[4] P. György, D. B. Melville, D. Burk, V. du Vigneaud, SCIENCE, 91: 243, 1940.

[5] F. Kögl and B. Tönnis, *Z. Physiol. Chem.*, 242: 43, 1936.

[6] E. E. Snell, R. E. Eakin and R. J. Williams, *Jour. Am. Chem. Soc.*, 62: 175, 1940.

[7] R. Nilsson, G. Bjälfve and D. Burström, *Naturwissenschaften*, 27: 389, 1939.

[8] P. M. West and P. W. Wilson, SCIENCE, 89: 607, 1939.

[9] Dr. Hofmann's participation in this work has been made possible by a fellowship granted to him by the Society for Chemical Industry, Basle, Switzerland.

[10] S.M.A. Corporation fellow.

AN IRRADIATED NON-VIRULENT ANTI-RABIES VACCINE

WE are attempting to improve antirabies vaccines for animal prophylaxis and for treatment of man.

The mouse potency test developed in our laboratory has proved reliable[1,2,3] and has shown that commercial phenolized vaccines of 1937 to 1939 for the most part failed to immunize mice, whereas chloroformized vaccines immunized, provided two to five times the stated dose was employed.[1]

New vaccines are now being developed and tested in mice and dogs with the following results. First, we found that to immunize mice about 1,000 mouse intracerebral lethal doses of virulent tissue culture virus were required and 50,000 doses of irradiated non-virulent virus.[4] Second, we learned that to immunize dogs weighing about 500 times as much as mice, 500 times this dose of irradiated virus was required. Since tissue culture virus contains a relatively small number of mouse doses per cubic centimeter, 33,000, large volumes were required to contain the proper number of doses for dogs—300 to 500 cc. As this volume was impractical for vaccination, attempts were made to increase the titre of virus in the tissue culture, but without success. On the other hand, a tenfold concentration of culture virus without loss of immunizing potency was achieved readily by freezing and drying procedures, so that 0.1 cc of concentrated irradiated vaccine immunized mice to the same extent as 1.0 cc of unconcentrated vaccine.

Infected brain tissue, however, remained the most potent source of virus. Brains from infected prostrate Swiss mice or 1-month-old dogs titred 33,000,000 or more mouse lethal doses per cc—this is 1,000 times the titre of tissue culture virus; guinea pigs generally titred 3,000,000, and rabbits 330,000 mouse doses per cc. From these infected mouse or dog brains an irradiated non-virulent vaccine was prepared as follows:

A 1 per cent. emulsion of virus-containing brain tissue was homogenized and then centrifuged at 500 r.p.m. for 5 minutes and the supernatant removed. This supernatant, in order to immunize, must titre 330,000 mouse doses per cc and be free of relatively large particles. It was rendered non-virulent by 20 minutes' exposure to ultraviolet light.

This material was then tested for its immunizing potency, as illustrated in the following protocol. Thirty mice were each given intraperitoneally a single injection of 0.5 cc (1,600,000 doses), thirty mice, 0.1 cc (330,000 doses), and thirty mice, 0.1 cc of vaccine diluted ten times (33,000 doses). Three weeks later these vaccinated mice plus similar non-vaccinated controls were tested for immunity against graded doses of virulent virus injected into the gastrocnemius muscle. Table I shows that 0.5 cc and 0.1 cc of vaccine protected the mice against at least sixty-four times the minimum fatal dose for non-vaccinated mice, and that 0.1 cc of vaccine diluted ten times protected them against four doses. Numerous experiments with mouse and dog brain vaccines and with various strains of street virus as the testing agent have given similar results.

TABLE I

IMMUNIZING POTENCY OF IRRADIATED 1 PER CENT. SUPERNATANT MOUSE BRAIN VIRUS FOR MICE

Virulence of brain-virus before irradiation, 0.03 cc $\times 10^{-7}$
Virulence of 1 per cent. brain-virus supernatant following 35 minutes' irradiation = 0

Immunity of Mice Vaccinated with Graded Doses of 1 Per Cent. Irradiated Vaccine

Amount of vaccine	No. of mouse intracerebral lethal doses in vaccine	Mortality of mice following intramuscular injection of 0.01 cc of virulent virus in dilutions:									Amount of immunity in minimum lethal doses
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1280	1:2560	
0.5 cc	1,600,000	1/5*	2/5	0/5	0/5	0/5	1/5	–	–	–	64
0.1 "	330,000	2/5	0/5	1/5	0/5	1/5	0/5	–	–	–	64
0.1 " (of 0.1 per cent. vaccine)	33,000	1/4	0/5	1/5	2/5	2/5	1/5	–	–	–	4
None	0	–	–	4/5	4/5	3/5	3/5	4/5	5/6	1/4	–

* 1/5 = 1 of 5 mice died of rabies following the test injection.
– = Dilution not tested.

The irradiated vaccine was tested in dogs with results illustrated by the following protocol. Eight young beagle dogs weighing about 300 times as much as the test mice were given intraperitoneally 30 cc of the non-virulent irradiated vaccine; eight were given 10 cc three times at weekly intervals, an amount at least 300 times the dose necessary for mice; eight* dogs received 6 cc of commercial chloroformized 20 per cent. vaccine intraperitoneally, and eight dogs were left unvaccinated as controls. Four weeks following the first injection all dogs were given 0.25 cc of 5 per cent. street rabies virus into the neck muscles of each side. Table II shows mortalities from rabies: eight of eight controls, 100 per cent.; four of six

* Two of these dogs died of distemper early in the course of the experiment.

[1] L. T. Webster, *Jour. Exp. Med.*, 70: 87, 1939.
[2] R. W. G. Wyckoff and C. E. Beck, *Jour. Immunol.*, 39: 17, 1940.
[3] K. Habel, *U. S. Pub. Health Rep.*, 55: 1473, 1940.
[4] H. L. Hodes, L. T. Webster and G. I. Lavin, *Jour. Exp. Med.*, 72: 437, 1940.

TABLE II

IMMUNIZING EFFECT IN DOGS OF IRRADIATED BRAIN ANTIRABIES VACCINE

Vaccination of dogs	Day of death from rabies	Per cent. mortality from rabies
Irradiated vaccine, 30 cc, 1 dose		0
Irradiated vaccine, 10 cc, 3 doses		0
Chloroformized vaccine, 6 cc. 1 dose	20, 23, 40, 43	67
No vaccine—controls	17, 20, 25, 27, 30, 30, 37, 41	100

dogs given chloroformized vaccine, 67 per cent.; none of the sixteen dogs given irradiated vaccine, 0 per cent.

Total mortalities to date among vaccinated and non-vaccinated dogs following test inoculation of rabies virus are shown in Text-Fig. 1 as follows: 115 of 136 non-vaccinated dogs, 84 per cent.; 45 of 62 receiving 5 cc of commercial phenolized canine vaccine subcutaneously, 72.6 per cent.; 22 of 44 receiving 5 cc of commercial chloroformized canine vaccine, 50 per cent.; 25 of 32 receiving less than 20 cc of the 1 per cent. irradiated vaccine, 78 per cent.; 2 of 10 receiving 20 cc, 20 per cent.; whereas only one of 35 dogs given 30 cc, and in one test 40 cc, succumbed to the test injection, 3 per cent.

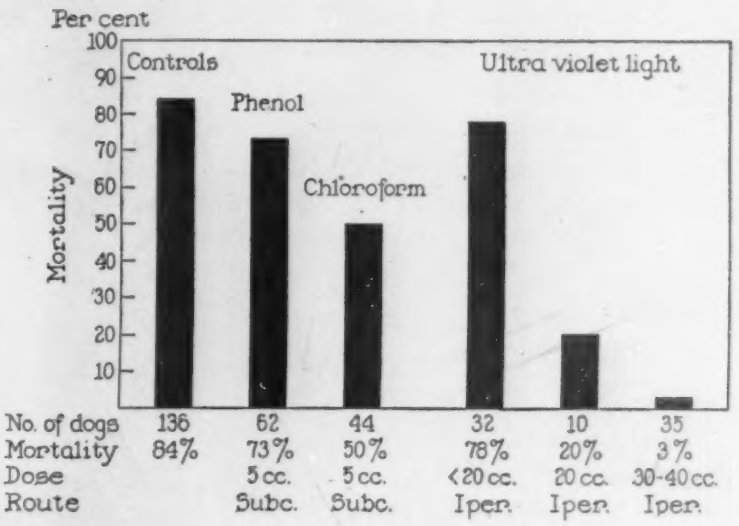

FIG. 1.

This irradiated vaccine retains its immunizing capacity after 9 months' storage at 40° F.

Experiments on further concentration of vaccine and optimum route of inoculation are in progress.

LESLIE T. WEBSTER
J. CASALS

THE LABORATORIES OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN INEXPENSIVE APPARATUS FOR DRYING FROM THE FROZEN STATE

SPECIALLY prepared calcium sulfate, "Drierite," has been suggested[1] as an economical desiccant for drying biological materials *in vacuo* from the frozen state. A simple, inexpensive apparatus has been devised for application of this principle to the preservation of virus and serum proteins.

The apparatus, shown in Fig. 1, is constructed about the large size (25 quart) National Canner Retort,[2] (A), which serves as the desiccant chamber. This retort can be purchased at low cost and most of the associated parts can be assembled in the laboratory. The retort comes equipped with a rubber gasket and an inside wire rack. In the cover are 4 fittings with $\frac{1}{8}$ inch standard pipe threads. The fittings are removed and 2 holes closed with standard plugs. A third opening is used as a vacuum release through the attached calcium chloride bottle (B). The fourth opening is rebored and threaded for a $\frac{3}{8}$ inch pipe elbow for the vacuum lead (C) ($\frac{1}{2}$ inch pressure tubing). In the center of the cover an additional hole is drilled and tapped with a $\frac{1}{2}$ inch pipe thread; into it is screwed an 8 inch length of $\frac{3}{4}$ inch O.D. brass tubing (D) for connection with the manifold (E). Into the lower end of (D) is sweated another brass tube (F) which extends within the retort to $\frac{1}{2}$ to 1 inch of the bottom.

The manifold (E) is $1\frac{1}{4}$ inch O.D. brass tubing 16 inches long. The 16 outlets (G) are 5/16 inch O.D.

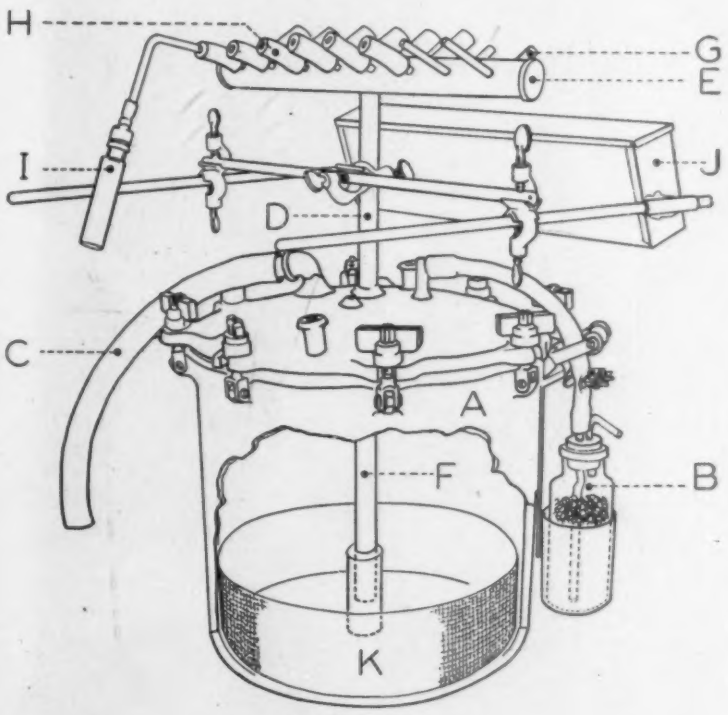

FIG. 1

brass tubing $1\frac{1}{4}$ inches long placed $1\frac{7}{8}$ inches apart at an angle of 60° from vertical. All brass to brass joints and manifold caps are soldered or brazed and

[1] E. W. Flosdorf and S. Mudd, *Jour. Immunol.*, 34: 469, 1938.

[2] National Pressure Cooker Company, Eau Claire, Wisconsin.

the threaded joints in the cover are sealed with "Apiezon."[3] Short lengths of ¼ inch pressure tubing (H) are used to connect the freezing and drying containers (I) to the manifold outlets. Construction and mounting of supports and of 2 sheet copper trays (J) for holding freezing mixture are evident. Castor oil may be used on the bevelled rubber gasket for sealing the retort.

The "Drierite" is held in 3 circular baskets (K) of hardware cloth, 3½ inches high by 11 inches in diameter, constructed with a tubular central opening through which passes the pipe extension (F). The 3 baskets are stacked in the wire rack supplied with the retort and may be removed separately or as a unit for regeneration of the desiccant. Details of the regeneration procedure are given by Flosdorf and Mudd[4] and for this a cheap gas oven is applicable.

The desiccant chamber holds 25 pounds of "Drierite," the total capacity of which is 400 cc without regeneration. The single run capacity is 125 to 150 cc and a Cenco Hyvac pump has proven adequate. Either preliminary freezing with a Dry-Ice-alcohol mixture or the degassing-self-freezing procedure[5] may be used, though the former method is recommended. Standard freezing and drying containers and connections obtainable on the market are used.

The apparatus shown may be constructed for approximately $35.00 or less and has been flexible and reliable in practice. It occupies only 4 square feet of table space.

A. R. TAYLOR
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DUKE UNIVERSITY SCHOOL OF MEDICINE

CONVENIENT HEAT FILTER FOR TISSUE ILLUMINATOR[1]

IN the quartz rod tissue illuminator described by Knisely[2] and in use at our laboratories, a large amount of heat accompanies the passage of light through the tissues. This occurs because some 85 per cent. of the energy consumed by the usual electric light bulb used as the light source is emitted as heat. The heating of the tissues being examined is usually minimized by flowing a continuous stream of properly warmed Ringer's solution over the area under observation. This treatment is not very convenient experimentally, and, as Knisely points out,[3] somewhat disrupts normal physiological processes. It was found in our laboratory that the insertion of a double thickness of inexpensive "heat-filter" glass (Cenco 87305) at the break in the quartz rod light conductor cuts down the heat transmitted to the tissue to at least one seventh of its previous value, yet reduces the intensity of light transmitted by only a small fraction. In general, this means that the heat transmitted is so small as to be safely absorbed by the tissue and thus the use of Ringer's solution as a cooling agent may be avoided.

HERBERT A. POHL
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BALTIMORE, MD.

[3] Sealing Compound "Q," James G. Biddle Company, 1211–13 Arch St., Philadelphia, Pa.

[4] E. W. Flosdorf and S. Mudd, *op. cit.*

[5] *Ibid.*

[1] Aided by a grant from the Rockefeller Foundation Fluid Research Fund of the School of Medicine, Johns Hopkins University.

[2] M. H. Knisely, *Anat. Rec.*, 58 (Suppl.): 53; *Proc. Soc. Exp. Biol. and Med.*, 32: 212; *Anat. Rec.*, 64 (Suppl.): 499.

[3] M. H. Knisely, *Anat. Rec.*, 64 (Suppl.): 499, 1935.

AN ELECTRONIC RELAY FOR HEAT CONTROL

SEVERAL letters have been sent us stating that the relay in the circuit we described[1] chatters when operated on 115 volts a-c. Our relay, equipped with a 50×–115-volt 60 cps coil, does not chatter but we also have found that many of the same type do. This chattering can be avoided by connecting a 450-volt 4 microfarad condenser (the electrolytic tubular type can be used) between the point marked C in Fig. 1 of the previous article and the No. 3 prong of the socket for the 25L6G tube. The positive terminal of the condenser should be connected to C. Using this condenser and shorting the 1000 ohm resistor nearest C, we have also been able to use the Potter and Brumfield relay, type PRA-1 with a 110-volt 60 cps coil, whose contacts are rated to carry 20 amperes a-c. There are, of course, many other makes of relays that can be used.

ALBERT C. HALL
LAWRENCE J. HEIDT
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

[1] SCIENCE, 92: 133.

BOOKS RECEIVED

BEAUCHAMP, WILBUR L., JOHN C. MAYFIELD and JOE Y. WEST. *A Study-book for Everyday Problems in Science.* Third edition. Pp. vi + 346. Illustrated. Scott, Foresman. $0.84.

BROWN, H. P. and A. J. PANSHIN. *Commercial Timbers of the United States.* Pp. xxi + 554. 312 figures. McGraw-Hill. $5.00.

Cowles Commission for Research in Economics; Report of Sixth Annual Research Conference on Economics and Statistics at Colorado Springs, July, 1940. Pp. 99. The Commission, University of Chicago.

HUNTINGTON, ELLSWORTH. *Principles of Economic Geography.* Pp. x + 715. Illustrated. Wiley. $4.00.

Johns Hopkins University Circular, November, 1940; Report of the President of the University, 1939–1940. Pp. 149. The University.

SALTER, WILLIAM T. *The Endocrine Function of Iodine.* Pp. xviii + 351. 40 figures. Harvard University Press. $3.50.

SCHUMANN, CHARLES H. *Technical Drafting.* Pp. xiv + 793. 857 figures. Harper. $3.50.

STUTZER, OTTO. *Geology of Coal.* Translated and revised by ADOLPH C. NOÉ. Pp. xiii + 461. 198 figures. University of Chicago Press. $5.00.

Important New McGraw-Hill Books

Applied X-Rays. *New third edition*

By GEORGE L. CLARK, University of Illinois. *International Series in Physics.* 663 pages, 6 x 9. $6.00

In the new edition of this well-known book the author, besides bringing the material up to date, has expanded the text considerably to include the remarkable developments of the past eight years. The chapter on interpretation of X-ray diffraction patterns is entirely new, and new chapters have been added on the measurement of intensity, photochemistry, the biological effects of X-rays, etc.

Industrial Microbiology

By SAMUEL C. PRESCOTT and CECIL G. DUNN, Massachusetts Institute of Technology. 515 pages, 6 x 9. $5.00

This book deals with the fundamentals of the utilization of yeasts, bacteria, and molds for the production of industrially important or potentially valuable products. The authors consider the organisms, methods of their cultivation, conditions of fermentation, end-products, and biochemistry of the fermentation.

Textbook of General Horticulture

By JULIAN C. SCHILLETTER and HARRY W. RICHEY, Iowa State College. *McGraw-Hill Publications in the Agricultural Sciences.* 363 pages, 6 x 9. $3.00

The object of this book is to set forth the essential principles of horticulture in a manner suitable for a general college course. The authors present a broad picture of the field of horticulture and its relations to agriculture and to the economic, political, and social life of the individual, and then discuss the fundamental plant processes and their application to horticultural practices.

Differential and Integral Calculus

By Ross R. MIDDLEMISS, Washington University. 416 pages, 6 x 9. $2.50

Intended for the usual beginning course, this book is unique in that it maintains a high degree of accuracy, and is at the same time exceptionally clear and readable. Throughout, it is the author's purpose to give the student a real understanding of the principal concepts of the subject.

Introduction to Electricity and Optics

By NATHANIEL H. FRANK, Massachusetts Institute of Technology. 395 pages, 6 x 9. $3.50

The publication of this long-awaited book completes the author's two-volume text in physics for the introductory technical course, the first half of which has been so successfully covered by *Introduction to Mechanics and Heat.* *Introduction to Electricity and Optics* gives a logical exposition of the fundamental principles, emphasizing field theory and the elementary application of these principles to circuits and to the electrical, magnetic, and optical properties of matter. The treatment is quantitative throughout and modern atomic ideas are stressed along with the more classical modes of presentation.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE STUDY OF THE SUN

ON hot days this summer, when the sun beats down unmercifully, most of us are delighted when a cloud gives temporary respite. But at four locations at least in the United States, where astronomers are studying the sun with powerful new instruments, clouds are most unwelcome.

This summer's American observations are especially important for two reasons. Because of the war, work that has been done in France in recent years will probably be suspended. Also, the new equipment will be put to use before the sun's activity diminishes to too great an extent. This varies over a cycle of about eleven years, and, while the maximum has been passed, we are still near enough to it to have many solar disturbances.

These are chiefly in the form of spots, great whirlwinds in the sun's atmosphere, where the expansion of the gases cools them, reducing their temperature from about 11,000 degrees Fahrenheit to a mere 7,500 degrees. This cooling of 3,500 degrees is far better than anything air conditioning on the earth can accomplish. With the gases cooler, and less luminous, they appear dark by contrast with the brilliant background. Even the spot, however, is brighter than an arc light.

Large spots, many times bigger than the earth, will undoubtedly appear this summer, some perhaps even big enough to be seen with the naked eye. But be careful, do not try to look at them with the uuaided eye. Smoked glass, a dense photographic negative, or a pinhole in a card afford means for looking safely at the sun.

Associated with the spots are the prominences, great flame-like masses of hydrogen and other gases that have been observed to shoot out from the sun, with speeds as much as 452 miles per second, to heights of a million miles. And even farther out from the surface is the corona, the pearly glow which can be seen with the naked eye at total solar eclipses.

In the past few years, two methods have been developed for observing the corona without an eclipse. One, using television methods, was invented by Dr. A. M. Skellett, of the Bell Telephone Laboratories, and successfully tried out at the Cook Observatory, near Philadelphia. The other, which uses optical methods entirely, was devised by a French astronomer, Dr. Bernard Lyot, and used from an observatory on the Pic du Midi, high in the Pyrenees.

This summer the Lyot method will be used by Dr. Donald H. Menzel, of Harvard College Observatory, working at Fremont Pass, Climax, Colo., at an altitude of 11,318 feet. An innovation in Dr. Menzel's equipment is the treating of all the lens surfaces by a process to make them non-reflecting. This still further reduces the glare that ordinarily hides the corona entirely. Dr. Skellett's system is to be applied at McDonald Observatory of the Universities of Chicago and Texas on Mount Locke, Texas, 6,790 feet above sea-level. Drs. C. T. Elvey and E. T. Rogers are working on this problem, under the supervision of Dr. Otto Struve, director of the observatory.

In addition, other solar observations, particularly of the prominences, are being made at the McMath-Hulbert Observatory of the University of Michigan. This observatory is located at Lake Angelus, Mich. One specialty of these astronomers is in making motion pictures of the prominences, from which accurate knowledge of the speed and movements of the gases have been obtained.

Dr. Menzel also plans motion pictures with the Lyot camera. These have the advantage of showing more detail than is possible with the system used at Lake Angelus, which photographs in the light of a single glowing element. The latter, however, can be used under conditions impossible for the Lyot camera.

Another important center of solar research is the Mount Wilson Observatory in California, where telescopes built into towers, one 75 feet, the other 150 feet high, are especially made for the purpose. Here the magnetic disturbances associated with the spots are studied. This is important, because the sun spots often cause magnetic storms upon the earth, disrupting communications, as they did on Easter Sunday.

From these locations, and also from others where less elaborate equipment is in use, the sun will be carefully watched, so that nothing of interest during daylight hours is likely to escape scrutiny. And even at night, for us, the sun shines in Canberra, Australia, where another great solar observatory is watching. From all these observations, we may learn, a little better, what effects the sun has on the earth.—JAMES STOKLEY.

THE AMOUNT OF ELECTRICITY IN A LIGHTNING BOLT

A SINGLE bolt of lightning, crashing from cloud to earth for about a fiftieth of a second, may contain a quantity of electricity sufficient to operate a hundred watt lamp for nearly three minutes. This has been learned from studies made with a new device, the "magnetic surge integrator," which Charles F. Wagner, consulting transmission engineer for the Westinghouse Electric and Manufacturing Company, described at the meeting in Swampscott of the American Institute of Electrical Engineers. He also told of two other devices which he and an associate, Gilbert D. McCann, have devised in order to answer about lightning strokes the questions, "when, how, how fast, and how much."

The "fulchronograph," which tells "when and how," consists essentially of an aluminum disc a foot in diameter, around the edge of which are inserted 400 small steel fins, each about half the size of a nail file. Every 1/25,000th of a second a fin pases through a narrow coil, where the lightning surge magnetizes it. The disc is returned to the laboratory after operation, and the amount of magnetization of each fin is measured. From these data the build-up of the electrical wave is determined.

The magnetic surge integrator is somewhat similar, but is designed to magnetize the strips continually through the duration of the stroke, so they carry a record of the total amount of electricity. The third device, the "mag-

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APPLIED PHARMACOLOGY

By HUGH ALISTER McGUIGAN, Professor of Pharmacology and Therapeutics, University of Illinois, College of Medicine. 870 pages, 41 illustrations. PRICE, $9.00

This brand new text, written from the rich experience that comes with more than a third of a century of teaching pharmacology to medical students, is the ideal text and reference work for every day use in daily medical practice. No matter what drug you may want to look up, you will find it here in this volume, together with its clinical use and application. The book is arranged for quick reference—and is dependable, up-to-date, is not too voluminous, but adequate in every way to give you needed information about drug action and therapeutic uses. It is one of the great books of the day.

Designed for practitioners and students, this book appears midway between revisions of the Pharmacopoeia. It emphasizes the theoretical foundations of pharmacology, and equally, the practical application. Theory and practice are happily combined in this book. The explanation of the action of each drug is given, its use in practice and the explanation of its effects.

HISTOLOGIC TECHNIC

This handbook of histological technic supplies specific directions to the beginner and inexperienced worker, and describes the latest improved methods for the experienced worker. The frozen section method has been emphasized, and a major purpose of the work is to present modifications of special staining methods which make their results more quickly available to the pathologist by the use of the frozen section procedure. By ARAM A. KRAJIAN. 272 pages, 44 illustrations, 7 color plates. Price, $3.50

MANUAL OF NEURO–HISTOLOGIC TECHNIC

The growth of neuropathology has been dependent in a large part upon the rapid advances made in the field of neurohistologic technique. At the same time, the array of technical methods recommended for the study of the nervous system leaves the beginner bewildered and discouraged. This compilation is an attempt to bring under one heading various neurotechnical methods which may be carried out in a general pathologic laboratory. By OSCAR A. TURNER. 72 pages. Price, $2.00

TEXTBOOK OF NERVOUS DISEASES

The subject of neurology as presented in this English Translation of the Fifth Edition of Bing's "TEXTBOOK OF NERVOUS DISEASES," attains almost the exactness of mathematics. Bing has elaborated on the latest advances in Europe, has unfolded his own immense experience based on minute and painstaking observations, and has brought to the practitioner as has no other textbook writer, detailed, precise therapeutics in an applicable form. By ROBERT BING. Translated by WEBB HAYMAKER. 850 pages, 207 illustrations, 9 in color. Price, $10.00

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This volume deals primarily with the principles which underlie the localization of lesions in the central nervous system. For many years Bing's text has been the accepted guide in America and Europe. The clarity of its style and description, the soundness of its differential diagnosis, and the wealth of information it contains make it valuable and necessary to you. By ROBERT BING. Translated by WEBB HAYMAKER. 292 pages, 125 illustrations, 7 plates. Price, $5.00

PSYCHOBIOLOGY AND PSYCHIATRY

This book, written at the invitation of Dr. Adolf Meyer, is an attempt to portray the main lines of his teaching. The strong clinical trend in the book needs no apology or defense. It is the basis of all medicine, and whatever laboratory and other special helps are given in extenso are to be considered exclusively in the nature of graphic illustration of what the clinical sense already knows or aims at. The book is divided into four parts: 1. Psychobiology. 2. Psychopathology. 3. Treatment. 4. Historical Appendix. By WENDELL MUNCIE. 770 pages, 69 illustrations. Price, $8.00

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netic surge front recorder," answers "how fast?" Four coils, connected in parallel with the wires over which the surge is coming, magnetize two small strips of steel. The amount they are magnetized is dependent on the change in current in the coils, so the maximum lightning current may be found.

PREVENTION OF SPREAD THROUGH THE BODY OF THE GERMS OF CANCER

(*Copyright, 1940, by Science Service*)

THE spread of cancer from one part of the body to another, which frequently makes it impossible to save the patient's life even by removing the original cancer, may be prevented as a result of a discovery announced by Dr. Oscar V. Batson, of the University of Pennsylvania Graduate School of Medicine, in the *Annals of Surgery*.

The discovery applies to the spread of germ diseases or infections. It is considered by medical authorities so important that the editors of the *Annals of Surgery* rushed Dr. Batson's technical report through the presses six months ahead of the usual schedule to make it available to the medical profession in the July issue.

The new route by which cancer and germs can spread through the body is along the "vertebral veins," that is, the valveless veins about the vertebral column and their connections. The discovery was made by injecting opaque material used in x-ray diagnosis into the veins of cadavers and of living animals. The injections showed that blood, and with it cancers and germs, can spread along the body through the vertebral veins, by-passing the heart and lungs. This is particularly likely to happen in coughing and straining.

As a result, it is no longer felt that as long as the lungs remain clear, the possibility of general spread of cancer or infection is remote. This idea was based on the long-held view that the lungs are the filter for infections and tumors spreading in the body. According to this old view, cases of general spread without lung involvement were called "paradoxical," although the paradoxes might occur in as many as 50 per cent. of the cases. "Routine examinations of the lungs by x-ray is therefore not enough," according to Dr. Batson. "The entire spine and adjacent parts must be routinely and repeatedly surveyed. The importance of early diagnosis and treatment becomes much more important. "Straining and heavy work may have to be avoided and prophylactic irradiation (by x-rays or radium) of large areas, particularly in pelvic, breast and lung tumors, may have to be introduced."

Dr. Batson explains his discovery as follows: "Ordinarily, tumors and infections are supposed to travel by lymph vessels and veins to the heart. Secondary tumors and infections may appear along this pathway. Before being spread to the rest of the body this contaminated blood stream must go through the lung capillaries (tiny blood vessels). But many times no secondary lesions (tumors or germ injuries) are found in the lungs, 50 per cent. to 70 per cent. in some instances. "These secondary lesions are especially numerous in the spine and skull. There has been no adequate explanation for this 'paradoxical' spread. An anatomic specimen injection into the veins would be expected to, and generally does, follow the big veins to the heart and lungs. However, injection of breast veins and small pelvic veins results in the injection mass filling the valveless vertebral veins and their connections. In the living monkey the usual course of injected material is into big veins. But when the pressure produced by straining or coughing is imitated, the flow is along the vertebral veins."

CIVIL AVIATION

POSSIBILITY of passengers crossing the Atlantic, between London and New York or Montreal, in an overnight hop, in planes traveling three hundred miles an hour, is foreseen by Dr. H. Roxbee Cox, formerly chief technical officer of the Air Registration Board, in a recent address to the Royal Aeronautical Society, London.

"There can be no doubt that when a country is fighting for its life, its primary aim is to win the fight," Dr. Cox said, "but it is generally agreed that we are fighting also for our civilization. It would seem axiomatic, then, that we must preserve the means of civilization, of which civil aviation is one."

He suggested that safety requirements might be varied, depending on the route of the flight. Over cool flat countries, between sea level airports, planes could carry more passengers than when flying over mountains, between high altitude fields in the tropics. In recent years, the British practice has been to set minimum requirements to suit the worst conditions, but this is uneconomical.

He called attention to the present transatlantic schedule of Pan American Airways planes, which operate at a speed of 170 miles per hour, making the trip eastward in 29½ hours and westward in 24 hours, allowing for the time difference in England and the United States, and the prevailing westerly winds. He pointed out that, after this, the obvious big step forward would be to make the journey overnight. That we can not at present consider this is clear from the calculation which shows that, though a westbound speed of 240 miles per hour would be adequate, an eastbound speed of 486 miles per hour would be required. He stated: "An approximation to the overnight ideal is possible at 300 miles per hour. This would allow arrival at Southampton at 10 A.M., if departure had been made from Montreal at 6 P.M. the previous day. I suggest, then, that the next big advance in operational speed will be 300 miles per hour. What degree of comfort should be supplied at this speed? The westbound passengers will be on board only thirteen, and the eastbound only eleven hours, and most of this time may be spent in bed. I suggest that weight and space might be more profitably expended in comfortable beds than in promenade decks and wine cellars."

With a daily service it would probably not be necessary for some time to cater for more than 250 passengers and 20,000 pounds of mail per week. This would be about thirty-five passengers per day, but to deal with fluctuations in load, the aircraft would probably need to have room for fifty passengers. He also suggested that it would probably be necessary to make the direct North Atlantic route, now used only in summer, an all-year-round one. He concluded: "There is, therefore, ahead of the operators a highly interesting and perhaps exciting period."

RECENTLY GRANTED PATENTS

GASOLINE of high quality can be efficiently produced from paraffin wax, by a process invented by Ernest W. Thiele, of Chicago, who has just been granted U. S. Patent 2,205,607. "In the manufacture of lubricating oils and paraffin distillates more wax is produced than is required for known commercial uses," the inventor states. "In many parts of the world naturally-occurring waxes are plentiful, although there is an insufficient amount of petroleum to satisfy motor fuel requirements. Various synthetic processes, such for instance as the Fischer process for converting carbon monoxide and hydrogen into paraffinic compounds, yield large quantities of paraffin wax. The object of my invention is to convert this wax into high quality motor fuel. A further object of the invention is to produce a motor fuel with better anti-knock characteristics than can be obtained by the thermal or catalytic cracking of other charging stocks." The wax is converted to gasoline by the action of heat of 850 to 1,000 degrees Fahrenheit, and a catalyst, such as acid-treated clay of the type used for decolorizing lubricating oils. Then, by distillation, the reaction products are separated. The process yields a product of which 40 per cent. is a high-grade gasoline. This can then be further refined.

Dr. Charles G. Abbot, secretary of the Smithsonian Institution, was another inventor whose work has been recognized by the Patent Office. He received, on June 25, patent 2,205,378 for a device to generate steam by action of the sun's heat rays. An aluminum reflector, shaped to a parabolic curve, focusses the sun's ray on a boiler tube, enclosed within an evacuated glass chamber, on the thermos bottle principle, to avoid heat losses. The boiler tube is painted black, to absorb as much heat as possible. A boiler of ordinary type is not efficient for solar work, Dr. Abbot explains, because the sun is occasionally obscured by clouds at most locations. "When the sky is clear around the sun," he states, "much time is lost if a boiler of large heat capacity is utilized because it requires considerable time to raise steam to the required pressure." With the "flash" boiler, that he uses, the boiler itself has very little heat capacity, so it quickly comes to the required temperature. Limited amounts of water are injected, and are immediately converted into steam. By a special mechanism, incorporated into his invention, the supply of water is regulated automatically "to suit the brightness of the sun from moment to moment, so that the water supply to the heater shall at all times be turned entirely into steam at a nearly uniform pressure while flowing through the boiler, being neither too great nor too small in amount." Dr. Abbot states that from his numerous experimcnts he has come to prefer the type of apparatus in which the boiler tube is inclined to the north, parallel to the axis of the earth. To follow the sun's daily movement, the reflector is rotated around the tube daily from east to west.

Another patent is a "radio autograph." It is similar to the wire-connected device used in railway stations, banks and other places where the motion of a pencil at the transmitting station is reproduced at the receiving end to write a message, except that the only connection between sender and receiver is by radio waves. This was invented by Clarence H. Kehm, of Chicago, and was granted patent 2,205,531.

John L. Lochhead, of Springfield, Mass., was awarded patent 2,205,426 for a water-cooled machine gun. A pump, operated by the gases of the exploding charges, circulates the water, so that firing does not have to be stopped to change the cooling water, as with present water-cooled guns.

ITEMS

W. B. BERGEN and Lee Arnold, of the Glenn L. Martin Company of Baltimore, speaking before the Institute of Aeronautical Sciences meeting at the California Institute of Technology, reported that a set of mathematical curves replaces weeks of laborious mathematical computations to allow aviation engineers to tell whether an airplane will "flutter" itself to destruction. Development of a graphical solution of flutter instability in airplanes is expected to result in safer planes and more rapid design. Flutter is a vibration that builds up with increasing force until a wing, aileron or tail flies off and the airplane is lost. Many otherwise unexplained crashes have been traced to flutter. Three years ago Martin engineers developed a vibration-detecting device that gave warning of dangerous conditions building up in an airplane during flight. The new work will greatly simplify the computation of the critical conditions that warn when dangerous flutter is imminent.

"PURE" and applied science are no longer separated by such sharp distinctions as both become better science, according to Dr. Ernest R. Hilgard speaking at the opening of a new psychology building of the University of California in connection with the meeting of the Western Psychological Association. It has been difficult to bring the very significant problems of social behavior—of domestic, economic and political life—into the psychological laboratory. But an important start has been made in this direction. Laboratory studies under controlled scientific conditions are giving us new understanding of conflict and frustration, rationalization, repression and other Freudian mechanisms. Important advances in realizing the effects on the personality of different forms of government are resulting from the study under laboratory conditions of the effects of democratic and autocratic leadership.

TWO new antidotes for poisoning from the scorpion's sting are suggested by Dr. Ali Hassan and Ahmed Hassan Mohammed, of the Faculty of Medicine, Egyptian University, Cairo, in a report to the *Lancet*. Atropine, familiar to laymen chiefly as the drops put in one's eyes for examination for eyeglasses, and ergotoxin are the two drugs suggested as scorpion toxin antidotes. They could be used alone or with the specific antiserum to cure persons poisoned by a scorpion's bite, it is suggested. No human trials are reported but one injection of the two drugs simultaneously given within two hours of a fatal dose of scorpion toxin saved the life of a dog. Rats were saved by either drug alone.

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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW DEFINITION FOR TEMPERATURE SCALES

ONE of the most fundamental standards of science and industry, the temperature scale, will have a new definition if suggestions now being put forward are adopted.

Now the essential points on thermometers, whether they be the familiar ones filled with mercury or colored alcohol or the more precise electrical and gas kinds used for greater temperature ranges and more exact measurements, are set by temperature of melting ice (0 degrees Centigrade and 32 degrees Fahrenheit) and the temperature of steam (100 degrees C. and 212 degrees F.).

Under the suggested change only the ice point would be standard and the steam point would be determined experimentally, just as the boiling points of liquids other than water are now determined. Actually the difference between the two systems would be very small indeed, but the change would (1) improve the accuracy of temperature determination, (2) fix by definition the values of the constants for converting ordinary Centigrade and Fahrenheit temperatures to Absolute temperatures, and (3) would eliminate revisions of previously determined temperatures as new determinations are made of fundamental coefficients of thermometric gases.

The possibility of the new standard was foreseen by the famous English physicists, Joule and Thomson, later Lord Kelvin, in 1854 when standards of the present temperature scale were being set. They recognized that when the temperature of the ice point became known sufficiently accurately, it would be desirable to use it alone to fix the scale. This time is believed to have arrived.

In the current issue of *The Journal of Applied Physics*, Dr. F. G. Brickwedde, chairman of the Committee on Low Temperature Scales of the National Research Council, points out that the definition of the temperature scale now in use is the result of an evolution and that it will continue to be changed to meet demands for greater accuracy and precision in the measurement of temperatures. Dr. W. F. Giauque, of the University of California, has proposed that steps be taken to bring about the adoption of the suggested change.—WATSON DAVIS.

CALCIUM IN THE SOIL

DR. WILLIAM A. ALBRECHT, head of the department of soils of the University of Missouri's College of Agriculture, points out that a plant may be growing, yet at the same time instead of taking nutrients from the soil which are needed to build up proteins, it may actually be giving up some of these nutrients to the soil. Speaking recently before the Midwest Regional Meeting of the American Chemical Society, held at Purdue University, he explained how advances in colloid chemistry help in understanding the way in which plants secure these nutrients from the soil.

"Only the finer clay fraction, a small part of ordinary soils, is really active in providing plants with nutrients. Seemingly clay can be so poor in its stock of such plant nutrients as nitrogen, potassium and phosphorus that a plant like the soybean may be running its woody tissue-making factory while the protein-making items like nitrogen and phosphorus are going in the reverse, from the plant to the soil."

Calcium does not move in the reverse direction, though when the clay gives it up, along with potassium and magnesium, for instance, it takes hydrogen in their places. Not a plant nutrient itself, hydrogen makes the soil acid. In reality, more soil acidity means less nutrients in the clay and less fertility for crop production. By adding lime, a calcium compound, to the soil, the effect of the hydrogen is counteracted, and there is less chance for the nutrients originally provided by the seed to be lost by going into the ground.

CONTROL OF THE JAPANESE BEETLE

INVESTIGATORS of the U. S. Department of Agriculture are engaged in spreading a disease in Maryland and parts of New York and Connecticut, to check the Japanese beetle.

Since the beetle entered the United States near Riverton, N. J., in 1916, it has spread over a wide area centering in southeastern Pennsylvania and New Jersey, running north to Connecticut and southeast to Maryland and Virginia. Traveling as a hitch-hiker on shipments of plants and produce, it has established outposts from Illinois to Maine, and from northern New York to Georgia. This year, it is believed, the beetles will be most numerous in the southeastern corner of Pennsylvania, the northern half of Delaware and a small section of southeastern New York.

Many methods of control have been found, but some, while effective, are too expensive for general use. Several parasitic wasps, which prey on the beetle in its native country and prevent it from becoming a pest there, have been introduced, and will probably be more effective when they catch up to the spread of the beetle.

The disease method has also given promising results, and is being extended this year. The most important seems to be the "milky" disease, caused by bacteria, which have been isolated, and made into a virus which is injected into healthy beetle grubs. The grubs die, their bodies are ground, mixed with talc, and spread over the earth, or placed in the soil. Other grubs feed on this, catch the disease, so that they too die. Then they turn milky white, and disintegrate, leaving piles of germs to be eaten by more grubs, so the disease spreads. Fortunately, only the beetles are subject to the ailment, and it is harmless to birds, plant life, domestic animals and human beings.

GROWTH-PROMOTING PRINCIPLES FOR ANIMALS

GOLDFISH grow significantly faster in water in which other goldfish have previously lived for a limited period than they do in other water. Dr. W. C. Allee, Asher J.

Finkel and Walter H. Hoskins, of the University of Chicago, have demonstrated that in the course of 20- to 30-day periods the average increase in size of goldfish living in "fish-conditioned" water over the increase in size of other fishes is a slight but statistically significant amount. Unfed fishes, experiments show, shrink less in "fish-conditioned" than in pure water.

There seems to be a growth-promoting factor in the mucus secretion from the skin of the "conditioning" fishes. This is indicated by the fact that fish-skin extract added to the water in minute amounts significantly increases growth. Dr. Lester Ingle and Mr. Finkel have gone a step further and shown that fish mucus stimulates the growth of even such very distantly related organisms as water-fleas (Daphnia). They have therefore come to believe that they may be dealing with a general growth-promoting principle of animals which may parallel the already well-known growth-promoting principles of plants.

Further experiments, by Mr. Finkel and Dr. Allee, in which minute quantities of tin chloride were added to the water, showed an increase in length of the fishes living in tin-conditioned water over the increases of other fishes during 20-day periods. Effective amounts of tin are so minute that it can be used practically in aquariums and some lakes.

Several years ago R. S. Young, of Cornell University, demonstrated that the growth of timothy, and also of algae, is stimulated by minute traces of tin. B. B. Cohen, of the University of Chicago, demonstrated last year that tin traces stimulate the growth of sunflower roots. The present work of Dr. Allee and Mr. Finkel shows for the first time that tin stimulates the growth of vertebrates. This discovery shows, also for the first time, a growth-promoting principle which plants and animals have in common.

THE CHINCH BUG SITUATION IN THE WESTERN GRAIN AREA

(*Copyright, 1940, by Science Service*)

FARMERS of the prairie grain region expect the next few days to bring developments in the chinch-bug situation in the states of Iowa, Nebraska, Missouri and Kansas.

Much depends on the weather. If it turns hot and dry, the bugs will attack in overwhelming numbers. If a sweeping, pelting rain comes, the situation will be greatly relieved. For the bugs travel mainly over the ground rather than through the air, and they are small so that a raindrop looms large to a chinch-bug. If rain fails to come and the bugs begin their march, they will find their route barred at field-edges by lines of paper. These, however, are formidable to the insect hordes, for they are impregnated with creosote oil.

The Federal Government, in preparations for the chinch-bug invasion, is sending tank cars filled with the creosote oil. Farmers who need it may have it for the taking. Promptness in availing themselves of this help is stimulated by notice that while the government will supply the oil, it definitely will not pay demurrage on cars left over-long on sidings.

In chinch-bug areas, the crisis is usually precipitated by the harvest of oats and wheat, in which the bugs do their early-season feeding and breeding. Suddenly deprived of their pasture, the pests migrate by billions to neighboring cornfields. They move over the ground like a dark, living carpet, and where they hit the corn and sink in their innumerable sharp sucking beaks, the standing grain wilts while you watch.

Unlike many of our worst insect pests, chinch-bugs are native Americans. They have been found all the way from Ohio to the Great Plains, but their principal center of disturbance is in the four-state "corner" mentioned in the first paragraph. They thrive on heat, and their present prevalence is a consequence of the drought cycle of the nineteen-thirties.

They are small insects, no bigger than mosquitoes, but shorter and stockier. They have wings but are weak fliers; wind rather than their own flight is what carries them for long distances when they take to the air at all. Usually, however, they creep in large masses, both the winged adults and the wingless young forms, known technically as nymphs. If you catch a small insect "with a white vest on backwards," and want to make sure of its identity, just squash it and sniff. Nobody who has done that ever forgets what mashed chinch-bug smells like.—FRANK THONE.

ANTI-POISON IVY VANISHING CREAM

A VANISHING cream that gives protection against poison ivy has been developed by Dr. Louis Schwartz, Dr. Leon H. Warren and Frederick H. Goldman, of the U. S. Public Health Service and the National Institute of Health. The formula for the cream, which is made by mixing either sodium perborate or potassium periodate with vanishing cream, will appear in the forthcoming issue of the *Public Health Reports.*

Tests on nine volunteers showed that the cream protects against both the poison ivy extract, which is at least thirty times as powerful as any poison ivy leaf, and against the leaves and stems of the plant itself. Two of the nine volunteers, one the most susceptible and one medium susceptible to poison ivy, after rubbing on the cream went out into the fields near the National Institute of Health at Bethesda, Md., and pulled out poison ivy plants by the roots, plucked the leaves, and rubbed them over their skins. Neither volunteer suffered any ivy poisoning from this. Dr. Schwartz and associates have no doubt the cream will be equally successful in protecting others against poison ivy if it is made and used according to directions.

The cream must be rubbed all over the face, hands, arms or any other part of the body likely to come in contact with poison ivy. After four hours, when the worker stops for lunch, it should be washed off with soap and water. Then after lunch, before going out into the fields or woods again, the cream should again be thoroughly applied all over the exposed skin, and again washed off at the end of the afternoon. The reason for washing it off and reapplying it at the end of four hours is to make sure the skin is all covered and so protected against the poison ivy. Some of the cream

is likely to rub off by the end of four hours and especially during the lunch hour.

In making the cream, and any druggist can do so, 10 per cent. sodium perborate is used, or 2 per cent. potassium periodate. These two substances come in crystals which should be ground into powder first because the crystals will not mix well with the cream. The vanishing cream should be made first and then the chemical added, otherwise the chemical will react with other ingredients of the vanishing cream and the result will not be satisfactory. The cream should be freshly prepared at least once in two weeks to avoid deterioration. It acts by filling the pores of the skin and forming a protective covering which prevents much of the ivy poison from penetrating the skin. As perspiration comes in contact with the vanishing cream, a soap is formed and the alkalinity of the soap tends to neutralize the poison ivy, in addition to washing it off and out of the skin.—JANE STAFFORD.

THE RADIO RANGE BEACON

BY means of a radio beam which sweeps around the horizon 60 times a second, airplane pilots can now find their course to a fixed beacon at all times. A dial on the instrument board displays a circle of light, around which an indicating mark moves to show the direction of the plane from the beacon.

Dr. David G. C. Luck described to members of the Institute of Radio Engineers the new device, developed under his supervision in four years of research at the RCA Laboratory at Central Airport, Camden, N. J. It is known as the "omnidirectional radio range beacon," and operates on ultra-high-frequency, minimizing the effect of static.

Previous radio beacons confine the pilot to a definite course. As long as he is following the course he knows it. If he goes off, he is also informed. But, though he can tell which way he is off, he can not tell how far he has left the course, nor what direction his destination may be. To provide this information, some air lines have used direction finders on the plane, which show the direction to the beam-transmitting station from the plane, but these are not satisfactory in the ultra-high-frequencies.

Dr. Luck described the operation of the new system as follows: "If the pilot must fly around bad weather on his regular course, he can always 'see' his direction from the radio station at a glance. If he wants to fly straight into or out from the beacon, he has only to hold the mark steady at that course against a scale on the instrument face.

"All this works like a lighthouse that sends out two kinds of light, one a beam which sweeps around steadily and the other a flash sent out in all directions just as the beam points north. Time the interval from the flash until the beam sweeps over you, and you know your exact direction from the lighthouse.

"In this new radio range, the radio lighthouse is on the ground and on the plane the indicating instrument automatically times the flash and beam. All this is done electrically, and our lighthouse beam sweeps clear around 60 times each second."

ITEMS

ON July 4 the sun was farther away than at any other time of year, according to the Nautical Almanac Office of the U. S. Naval Observatory. Its distance was 94,239,000 miles. This was 2,896,000 miles farther than it was when closest, on January 2. The fact that we have warm weather now, with the sun so far, is explained by the fact that for people in the northern hemisphere it is higher in the sky, and its rays of heat fall more directly, and are therefore more concentrated.

A LAW recently passed by the Congress and approved by the President protects our national bird, the bald eagle, imposes fines up to $500 for taking, possessing or dealing in these birds, except in Alaska. It has been threatened with extinction.

THE day when participants in a telephone conversation will be able to see each other may be brought nearer with the invention of Dr. Vladimir K. Zworykin, of Philadelphia, granted patent 2,206,654, by which two-way television may be accomplished over a single pair of wires. Essentially this consists in sending both ways over the wires at once. A blurred image, like a photographic double exposure, would normally be obtained at each end. "Blanking out" amplifiers are provided at each end of the line, which permits the transmitting tube to send and the viewing tube to show only alternate pictures in the series that is constantly coming over the line. These automatically switch back and forth so that first a picture is sent in one direction, then one goes in the opposite direction. All this is so fast that the persons at each end see a continuous picture, though not with as good quality as if the transmission were continually in the same direction.

THE world's largest projection screen, 200 feet long, was put into use on July 2 in the Hall of Aviation at the New York World's Fair. A battery of 20 projectors, placed in a central revolving tower, flashed a group of pictures on a wide expanse of curving wall. Reproduced in color from paintings and photographs made especially for the display, the pictorial pageant depicts the far-flung activities of present-day aviation. A voice narration accompanies the pictorial presentation. Sponsored by the aviation industry and the New York Museum of Science and Industry, experts on the museum staff developed the technique by which the individual pictures, each 24 feet long and 16 feet high, are projected so accurately that they flow into each other and the audience has no feeling of separate units.

AN electrical micrometer is the latest form of vacuum tube. About the size of those used in radio receivers, the tube has a rod projecting from its end, which forms the sensitive element of the micrometer used for measuring minute displacements. When connected with the proper electrical circuit and meter, a movement of the rod produces a movement of the indicating hand of the meter 10,000 times as great. With the hand moving a tenth of an inch, a motion of the rod of one one-hundred-thousandth of an inch will be shown.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PRODUCTION OF RADIUM-LIKE SUBSTANCES

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ARTIFICIAL production of substances like radium, which can probably be produced much less expensively than the natural material, yet have the same qualities that make it useful in medicine, is covered in United States Patent 2,206,634. This has just been granted to five Italian physicists, who were at the University of Rome when application was made for the patent on October 3, 1935. They are now widely scattered.

Chief of the group is Dr. Enrico Fermi, Nobel laureate in physics in 1938. At the end of that year he came to the United States to join the faculty of Columbia University, New York City. His co-patentees are Edoardo Amaldi, still in Rome; Emilio Segre, University of California, Berkeley; Franco Rasetti, Quebec, and Bruno Pontecorvo, now in South America. The patent is assigned to G. M. Giannini and Co., Inc., New York City.

Most chemical elements consist of several "isotopes," which have similar properties except that they differ in atomic weight. In radium, and other substances naturally radioactive, there is a disintegration into various isotopes of other elements. This is accompanied by the emission of the alpha, beta and gamma rays, which produce the effects of radium.

In 1934 the French physicists, F. Joliot and his wife, Irene Curie-Joliot, daughter of the Curies, discoverers of radium, found that radioactivity could be started artificially. They bombarded light elements, like boron, with alpha particles from radium. After the bombardment ceased, the boron itself gave off some of the radium rays. Later, other ways were found of producing the same effect. By bombarding with other rays or particles of high energy, isotopes of different elements can be converted into other isotopes. These may be of the same or of other elements. Some of them are so unstable that they quickly decompose. In doing so, they show radioactivity.

The first efforts were to get bombarding particles or rays with energies as high as possible, but Dr. Fermi found this desirable only when the particles were electrically charged. Then high energy was needed to break through the barrier surrounding the nucleus of the atom. With neutrons, electrically neutral particles, the greatest efficiency is obtained with low energies.

Neutrons can be produced in various ways, chiefly by the use of the cyclotron, invention of Dr. E. O. Lawrence, of the University of California, who was awarded the Nobel prize last year. These neutrons, however, have very high energy, so Dr. Fermi's problem was to slow them down, and reduce their energy.

"We have found it possible to achieve the desired results by passing the neutron radiation against or through a screen of a suitable material," states the patent. "The materials which have been found best suited to this purpose are those containing hydrogen (including all its isotopes, but the light isotope which predominates in natural occurrence being most efficient) and especially water and the hydro-carbons, such as paraffin for example."

In use, the screen may be either solid or liquid. In the latter event, the material to be treated can be dissolved or suspended in the liquid itself. The new patent covers the use of neutrons, with such an energy-reducing screen and the production of radioactive isotopes thereby. Since this is so far the only satisfactory method of producing artificial radioactive substances, and these have begun to find medical use, the patent seems to be quite basic.

Sodium has been one of the most widely used elements, but many others show the effect. The patent specifications list all those that have been tried, including most of the 92 known. Platinum, gold, iodine, potassium, copper and chlorine, among others, can be made more or less radioactive. Certain elements, including hydrogen, carbon, tin, thallium, lead, bismuth and mercury, showed no activity. With these, it is supposed, the neutrons produce a change to a staple isotope.—JAMES STOKLEY.

THE COST OF WAR PLANES

THE thousands of warplanes ordered for defense by the government will cost about $7.50 a pound. The announced goal of 50,000 a year means the production of 500,500,000 pounds of airplanes, engines and propellers. Cost will be about $3,500,000,000, a sizable slice of the nation's income. And this does not include the men to pilot them, the bombs they will carry, the extensive ground crews to maintain them, and hundreds of other incidental and essential costs.

These figures are from an authoritative analysis of the program by T. P. Wright, engineering vice-president of Curtiss-Wright Corporation, now specialist to the National Defense Commission, published in the journal, *Aviation*.

Time is of the essence. But there are no wild dreams of great flocks of warbirds overnight or even in a few months. It took Germany four years to go from 4,300 to 31,000 total air strength. It is estimated that an airplane production rate of approximately 2,000 a month, or 24,000 a year, can be achieved in 2½ years or by January, 1943. Over 4,000 planes a month, or 50,000 planes a year, can be realized in 5 years or by July, 1945.

It will require about $500,000,000 invested in new plants —some 75,600,000 square feet—to carry out the program. Men needed will be about 800,000 compared with 100,000 now employed in the aircraft industry. Research will have to be speeded and amplified, because if we do not improve designs as we go along, the planes will be obsolete and easy prey to more advanced production. As we build airplanes we shall have to recapture aviation research leadership from Germany and Italy.

Comparison figures: The cost of aircraft plant expansion, half a billion dollars, is what France spent on her ineffective Maginot line. The cost per pound, delivered, of ordinary popular priced automobiles is about 30 cents, contrasted with the $7.50 per pound for airplanes.—WATSON DAVIS.

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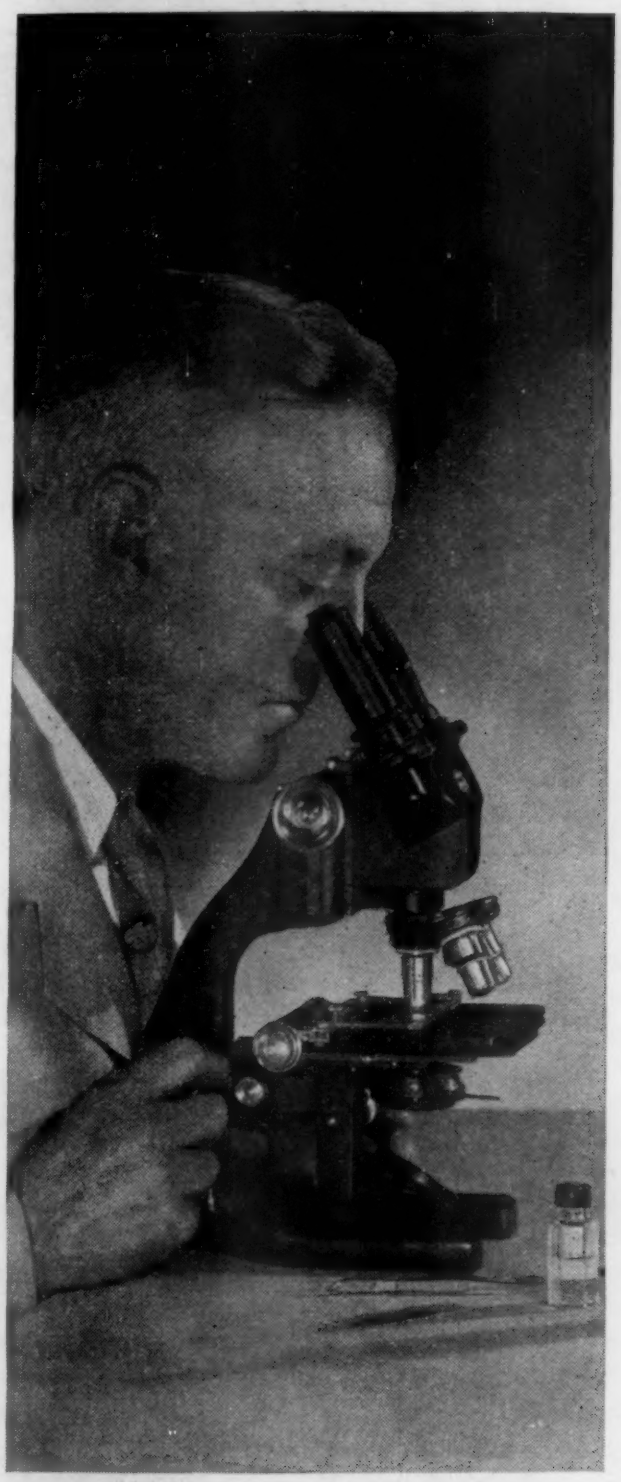

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A NEW CANCER SERUM

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A SERUM that may aid diagnosis of cancer and may even have value for treatment of the malignant disease has been developed by Professor William H. Welker and Dr. Lawrence S. Mann, of the College of Medicine of the University of Illinois. Announcement of the serum is made to the medical profession in the current issue of the *American Journal of Cancer*. The serum gave positive reactions with the blood of cancer patients in a high percentage of cases. In cancer of the stomach the percentage was 57 per cent. In cancer of the womb the percentage was 87 per cent., or seven positive reactions in eight cases tested.

No cures nor attempt to cure cancer are mentioned in the technical report which describes the preparation of the serum. Professor Welker, in a communication to Science Service, expressed the hope that the report would not have the "cruel" effect of raising false hopes in laymen who might expect more of the serum than can be guaranteed on the basis of present knowledge about it.

Blood tests with the serum were made by stratifying diluted human blood serum, from either normal persons or cancer patients, over the rabbit cancer antiserum. A white ring developing at the zone of contact after a period of one hour indicated a positive reaction. The serum is prepared from the blood of rabbits injected with aluminum cream (aluminum hydroxide) containing ground and specially treated cancer tissue. This has the effect of mobilizing in the rabbits' blood the defensive troops called antibodies. The particular accomplishment in preparation of the serum, which has been attempted many times before, was to cause mobilization of antibodies specifically capable of dealing with the protein of cancer tissue.

The difficulty in the past in preparing such a specific antiserum for cancer protein has been that when cancer cells were injected into rabbits, not only cancer-fighting antibodies but also antibodies for handling foreign blood were mobilized. This was because of the difficulty of separating cancer proteins from the blood proteins. As a result, the reaction of the serum with the blood of cancer patients might be a reaction with the blood and not just with the cancer proteins, if any were present in the blood. Consequently the previously prepared serums could not be used successfully in cancer diagnosis tests. According to the tests made, the serum prepared at Chicago is specific for cancer protein. It reacts only with cancer tissue or with the blood of cancer patients. It does not react with the normal tissues nor with the blood from normal patients.—JANE STAFFORD.

THE TREATMENT OF MUSCULAR WEAKNESS WITH HORMONES

"CLOSE to miraculous" results from the hormone bank treatment of the chronic progressive disease of muscular weakness, myasthenia gravis, are reported by Dr. Robert C. Moehlig, of Detroit, in the current issue of the *Journal* of the American Medical Association.

The treatment consisted in burying under the patient's skin little pills of desoxycorticosterone acetate, a synthetic chemical believed to be the same as the cortical hormone produced by adrenal glands. The pills or pellets of this substance act like a bank of the hormone material on which the body can draw for its daily needs. This treatment with the synthetic adrenal hormone chemical was first used for patients suffering from another ailment, Addison's disease, which is an adrenal gland disorder.

The case Dr. Moehlig reported was that of a 32-year-old physician. Like other sufferers from myasthenia gravis, this patient got out of breath, weak and tired on the slightest exertion. The history he wrote of his own case states that he "could hardly raise his arms to shave or comb his hair. The weight of the head and shoulders and the effort to hold himself upright seemed intolerable." He had trouble in swallowing and talking, and felt "utterely exhausted" and drowsy most of the time.

Injections of the synthetic hormone chemical definitely relieved the weakness and fatigue, starting five hours after the injection. The effect, however, was only temporary, so it was decided to give the patient a more lasting supply by implanting pellets of the chemical to create a hormone bank. Dr. Moehlig states that "The effect of the pellet implantations has been close to miraculous in its sustained and complete relief of symptoms." No symptoms of the disease were noticeable three and one half months after the pellet implantation. The supply implanted last October was calculated to last 450 days.

"Naturally," Dr. Moehlig cautions, "further experiences with other patients as well as the continued progress of this patient are desirable before final conclusions concerning lasting benefits are made." He gives several reasons for trying the Addison's disease treatment in the case of myasthenia gravis. For one thing, loss of strength and fatigue are in a general way outstanding symptoms of both conditions, although in myasthenia gravis the tiredness comes only when the muscles affected by the disease are called on for sustained effort. The patient's past history furthermore indicated muscular weakness and a congenital predisposition to disturbance of muscle metabolism, and both the pituitary gland and the cortex of the adrenal glands are concerned with muscle metabolism.

FINGER PRINTS

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THOSE who operate their own transmitters may have to register their fingerprints at the post office.

The Post Office Department has been requested to take the fingerprints of all radio operators at the same time that they register aliens. As yet they have not accepted the invitation.

The alien fingerprinting, which is to start on August 28, will be done in post offices and possibly also in schools or other places. It is expected that standard fingerprint cards for all ten fingers will be used, such as those already in use for criminals by the Federal Bureau of Identification. Aliens' prints probably will be filed with the bureau. The details of the plan have not, however, been definitely settled as yet. Probably black ink like printers ink will be used.

Although the post offices are already taking fingerprints in connection with their postal savings accounts in some 690 of the largest offices, it is not anticipated that the

post office fingerprinting system will be used in registering aliens. For postal savings only the first three fingers of the right hand are printed. A stainless system developed about 20 years ago by the National Bureau of Standards is used instead of the rather messy ink. The applicant dips his fingers in a paste of lead soap and ferric chloride to make the prints which are then developed in sodium sulfide and sodium carbonate. Fingerprints are also used for identification purposes by the Civil Service Commission, which fingerprints all government employees under Civil Service. The Army, the Navy, Coast Guard, Marine Corps and the Veterans Administration identify their personnel by fingerprinting.

All applications for the soldier's bonus were required to be accompanied by the prints of the five fingers of the right hand of applicant. These were checked with the prints in the files of the Army. Then at settlement, the fingerprints were taken again to insure that the right person collected the money.

The U. S. State Department uses fingerprints in an unusual way. Passports for use of Americans in Europe these days must bear a fingerprint, but it is not the fingerprint of the person holding the passport. It is the imprint of the thumb of an official in the U. S. State Department, and it is assurance that the passport is genuine.

COMBATTING FOREST FIRES

STREAMLINED fighting units instead of old-time mass formations are coming into use in combatting one of America's worst economic menaces, the forest fire. Tried out for the first time last year by the U. S. Forest Service, the new tactics proved so satisfactory that their use is now being extended.

The traditional method for stopping a forest fire has been to round up casual laborers and even hoboes by hundreds, arm them with tools which they hardly know how to use, and send them to the fire front. Unsuited for the work, usually in poor physical condition, these men naturally work inefficiently, especially under the terrific stress and danger of a forest fire battle. Furthermore, the method of recruiting involves delay, frequently of days, while the fire rolls forward unchecked.

The new tactics involve the building of what amounts to a small standing army, skilled in the use of their weapons, kept in perfect physical trim and ready for instant action. Formations are in companies of 40, each divided into squads of 10. The men are permanently on the payroll; when not fighting fires they are kept busy building roads, bridges, etc. The original 40-man crew, that went into action last year, averaged nearly six feet in height and 170 pounds in stripped weight.

Instead of having each man try to clear and hold one short section of line, such a company moves steadily forward. Each man strikes one blow, with ax or other tool, for every couple of strides he takes. Those following do the same, so that by the time the 40 have passed there is a swath of ground cleared of everything combustible, and the fire can not pass.

The forties constitute a corps d'elite, sent into the toughest spots and taking pride in their ability to lick the hungriest fire. Last season's performance indicates that one of these professionals can clear five times as much fire line in a given time as the untrained fighters hastily recruited after the fire has broken out.—FRANK THONE.

ITEMS

TEN regular cycles in variation of the radiation of the sun, six of which at least seem closely related to the large eleven-year period over which the sun-spots wax and wane, have been found by Drs. Theodore E. Sterne, Karl F. Guthe and Walter O. Roberts, of the Harvard Observatory, who have made an intensive mathematical analysis of observations obtained over a fifteen-year interval by the Smithsonian Institution. A report on the work has been made to the National Academy of Sciences. Variations in the radiation are very small, and it has been suggested that they are due to chance differences in the atmospheric blanket which surrounds the earth. It is extremely improbable, however, that accidental errors would produce the fluctuations found. Most significant is that six of the variations are submultiples of 10.2 years. The length of the sun-spot cycle, over which these solar tornadoes become very numerous, then die out again, has had an average length of 11.3 years in the past century. It varies, however, and the average of the two cycles which were included in the data analyzed was 10.1 years. This indicates that the six fluctuations are components, or "overtones," of the main cycle, and due fundamentally to the same cause.

GLASS rods, light green in color, which turn purple when exposed to daylight, now afford a simple means of measuring the intensity of ultra-violet rays, which cause sunburn. Dr. Helmut Landsberg, assistant professor of geophysics at Pennsylvania State College, has developed the method. As used in this region, the rods complete the color change in about six hours of summer midday sun, but in the winter a longer time is needed. There is also a difference depending upon location, as shown by tests made in many parts of the country. In general, the southern states showed 30 per cent. to 50 per cent. more ultra-violet than the northern. Rio Piedras, Puerto Rico, gave the highest value, with Tucson, Arizona, a close second. Reno, Nevada, also scored high, but New York and Pittsburgh were quite low. In these large cities, ultra-violet light is reduced by dust in the atmosphere. Very short wave-lengths in ultra-violet light produce painful burns. The longer waves, just a little too short to be visible as violet light, produce tanning without burning.

A CASE of relapsing fever, a tropical disease rarely seen in the United States, is reported by Dr. W. P. Neilson, of Enid, Okla., to the *Journal* of the American Medical Association. The case is the first ever reported in Oklahoma. The disease is caused by the kind of germ known as a spirochete and is generally transmitted to man by the bite of an infected louse or tick. Dr. Neilson's patient did not remember being bitten by any insect and did not show any signs on her skin of such a bite. She lives on a farm, but does no outside farm work where she might be bitten by ticks, and there are no rats or other rodents around to harbor the germs. She had not been away from her immediate vicinity and no foreign guest had visited the home. She was cured of the ailment by the chemical, neoarsphenamine.

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SCIENCE NEWS

Science Service, Washington, D. C.

ATOMIC STRUCTURE OF METALS

FROM iron "jackets" which encase certain stars and give out peculiar kinds of ultra-violet light, incapable of reproduction in laboratories, it is hoped to learn more about the atomic structure of important earthly metals.

Reporting in *The Astrophysical Journal* on researches he has made at the McDonald Observatory of the Universities of Chicago and Texas, Dr. Otto Struve, director of the observatory and also of the Yerkes Observatory, writes that: "The importance of this work consists in the fact that it provides information about some of the most common and useful substances, including chromium and titanium as well as iron. Such information can be found only in the stars."

The metallic jackets around these stars are in gaseous form, at temperatures far higher than the boiling point of iron. Subjected to this intense heat, the atoms give off radiations which can not be produced on earth, partly because there is not enough gaseous iron on the earth, and also because such high temperatures can not be reached. For this reason, physicists refer to these radiations as "forbidden."

In the new researches, which Dr. Struve carried out in collaboration with Dr. Polydore Swings, of Belgium, who has recently joined the University of Chicago staff, many previously unknown radiations of this kind have been discovered. That they do occur provides a test of the theories of radiation, which "forbid" them on earth, and also for the theories of the atomic structure of the metal.

Dr. Struve has found that "the nebulous shells emitting forbidden radiations of iron very often occur in double stars. There can be no doubt that the formation of the iron shell is in some way connected with the fact that the two totally different stellar bodies are close to each other. The forbidden radiation is rarely, if ever, exhibited by single stars," he said, suggesting that "gases which originally belonged to the cool supergiant, in a pair, may have been torn off because stimulated by the ultra-violet light of the hot companion star. This action would be analogous to the action of the moon in producing tides on the earth.

"Another analogy to the action of the hot star is that of the northern lights produced in our own atmosphere. In this case the sun excites the molecules of the upper atmosphere. These molecules then emit 'forbidden' radiations of nitrogen and oxygen, two of the principal constituents of the air."

AN AUTOMATIC MECHANICAL ANALYZER FOR METALS

(*Copyright, 1940, by Science Service*)

AN automatic machine which rapidly and accurately analyzes various materials, an invention expected to prove of great value in accelerating the inspection of metals and alloys in the nation's defense program, has been developed by Professor George R. Harrison and his associates at the Massachusetts Institute of Technology.

The device, known as an automatic high-speed recording spectrophotometer, not only analyzes materials, as does the spectroscope, but quickly draws the graphs and curves depicting the results of its analysis. It completes the entire process for a given sample in about 100 seconds—less than two minutes.

Heretofore, a spectrograph has been used to analyze the material, but it has been necessary to interpret this analysis on other machines, a procedure which often required half-a-day or more. The new device makes records and interprets 20 measurements a second, doing so with an accuracy of one part in a hundred.

The device covers a broad spectral range, making its investigations not only in the visible range of the spectrum but also in the infra-red and ultra-violet regions. It is fairly simple in its operations and, according to Dr. Harrison, could easily be adapted to similar problems.

Because of the speed at which the device operates, it is especially useful in studying the progress of chemical reactions. This should be valuable in such physiological problems as those involving vitamins, hormones and other biochemical substances.

One of the secrets of the apparatus is the use of the methods of television in the form of an electron-multiplier tube in measuring light intensities and a "memory device" to translate various measurements.

A ROBOT WEATHER OBSERVER

AUTOMATIC weather observing stations, untouched by human hands for months at a time, may soon be scattered around on high mountain peaks or at inaccessible sea locations so that meteorologists can have complete and automatic radio reports on the changing weather, necessary for predictions.

A radio weather robot, developed by Harry Diamond and Wilbur S. Hinman, Jr., of the National Bureau of Standards, with the cooperation of the Naval Bureau of Aeronautics, has undergone a successful two-months' test at the Naval Air Station at Anacostia.

Radio messages that it sends out at predetermined intervals tell the barometric pressure, air temperature, relative humidity, wind direction and velocity, rainfall and other meteorological factors.

A mechanical cousin to the high-flying radio sondes now extensively sent aloft by means of unmanned balloons for upper-air weather information, the new robot weather station is designed for stationary installations. It is actually simpler than the radio sonde type of weather observing machine.

By operating on a relatively low frequency, signals from the automatic weather station can be received with any standard receiver. Even through severe static interference, it will only be necessary for the operator, with stop watch, to listen in and count the number of signals received in a given time. These can be decoded into the values of the various weather factors automatically observed at the distant place. In some cases automatic recording receivers may be used.

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The essence of the book is found in the latter half where are presented the results of the impact of curious low-temperature phenomena on modern theories of matter, the nature of superconductivity, the behavior of specific heats and magnetic properties of matter and the freakish antics of liquid helium below 2° K. Particular attention has been given to the definition and measurement of temperature, and to the intriguing problems of the approach to the absolute zero.

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A GERM-KILLING CHEMICAL FROM SOIL BACILLI

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PROMISING results in the first trials at treating a real sickness with gramicidin, a germ-killing chemical from soil bacilli or germs, are reported by Dr. R. B. Little, R. J. Dubos and R. D. Hotchkiss, of the Rockefeller Institute for Medical Research.

The power of this chemical from one kind of a germ to kill other germs that cause deadly diseases caused a sensation in both lay and scientific worlds when Dr. Dubos first announced it. At that time the chemical's germ-destroying ability had been shown in test-tube experiments and in laboratory mice sick with peritonitis which had been given to them by injections of pneumonia germs and streptococci.

Trial of the chemical as a remedy in cases of real sickness, instead of experimental ones in the laboratory animals, has now been made. The patients were cows at the Rockefeller Institute's department of animal and plant pathology at Princeton, N. J. They had a chronic form of bovine mastitis caused by germs of the streptococcus family. The germs in this disease generally get into the cow's milk and while they may not cause disease in humans drinking it, they have a deleterious effect on the milk.

Treatment of the cows consisted essentially of injecting a solution of gramicidin into the infected quarter after milking and allowing it to remain until the next milking. "While the streptococci were not eliminated from all of the infected quarters," the Rockefeller scientists report to the Society for Experimental Biology and Medicine, "they were markedly decreased after each treatment, and the findings thus confirm the results obtained in mice, namely, that gramicidin, when injected directly into an infected focus, exhibits a definite bactericidal effect against streptococci."

The treatment did not produce what might be called a permanent cure in all the animals treated. This may have been due to the fact that the method of giving the chemical could be bettered. The state of lactation and other factors may have been responsible for the partial failures. It is pointed out that these factors must be considered, and many more animals must be treated over a longer period of time before the effectiveness of gramicidin in the control of bovine mastitis can be determined.

INFANTILE PARALYSIS

(*Copyright, 1940, by Science Service*)

DRINKING water and the water in swimming pools may after all prove to be a means by which infantile paralysis is spread. Fresh evidence strongly supporting this old theory, which has been discounted in recent years, is reported by Dr. J. Emerson Kempf and Dr. Malcolm H. Soule, of the University of Michigan, to the Society for Experimental Biology and Medicine.

Chlorination as now practised to make drinking water and swimming pool water safe does not kill the virus of infantile paralysis. The report states that "The possibility that drinking water, adequately chlorinated according to accepted standards, may be a factor in the epidemiology of poliomyelitis (infantile paralysis) must be recognized as a result of these findings. As a corollary, attention is directed to the shortcoming of this method for the protection of swimming-pool water since carriers may discharge the virus from the intestinal tract or the naso-pharynx and the chlorine content of swimming pools is apt to drop significantly during peak bathing loads."

The discovery that the infantile paralysis virus can survive in chlorinated water was made after the virus had been found in sewage in the Charleston and Detroit epidemics in 1939. The infantile paralysis virus was also found in the intestinal discharges of healthy persons in contact with infantile paralysis patients in a Detroit institutional outbreak. While this indicated that water could carry the germs in the same way that it can carry germs of typhoid fever, it was not supposed that drinking water was a means of spreading the virus. For one thing, epidemics of the disease occurred in large cities with chlorinated and presumably safe drinking water. As recently as 1939 it was reported in France that chlorine in a concentration of four tenths parts per million in tap water destroys the virus.

In ordinary practice in this country, however, a residual chlorine content of one tenth to two tenths parts per million for one half to two hours is considered adequate for the production of a safe water. It is now found that "chlorine in a concentration of five tenths parts per million, which is an amount in excess of that usually employed in municipal practice, did not inactivate the virus of poliomyelitis in one and one-half hours."

The idea that infantile paralysis could be spread by water is not new. Many persons are said to have been attacked by the disease after going in swimming. This method of spread, however, seemed unlikely when experiments seemed to show that the virus of the disease is spread through the air and enters the body through the nerves of smell in the nose.

Drs. Kempf and Soule do not say in their report that the disease is not spread via the air to the nose. They only show that the other method of spread via water is possible. They point out that more sensitive methods of detecting the virus of infantile paralysis in water are needed, and that because these are lacking, negative results of tests do not necessarily assure that the water is free from the virus. The germs of typhoid fever, for example, are seldom found by direct tests even though they may be present in the water supply.

The problem of finding a means of making drinking water free from infantile paralysis virus by treatment other than chlorination is probably the next to be studied by public health officials.

FOREST FIRES

FIRE danger in forests of the West continues serious, as persistent drought keeps the forest-floor litter dried to tinder. Already the number of fires is half again as large as it was last year, which was close to the five-year average, 1935–39, it is shown by a digest of hundreds of reports from the field received by the U. S. Forest Service.

For the entire western half of the country (exclusive of Texas) the number of forest fires recorded so far this year is in excess of 3,300. The total number for 1939 to the same date was only a little above 2,000; the 1935–39 average was 1,931.

Figures for the eastern states, plus Texas, show an increase not quite so marked but still bad enough. There have been more than 4,000 fires in eastern and Gulf Region forests thus far in 1940, as against a few more than 3,000 to the same date last year, and a 1935–39 average of nearly 3,700.

The fires have not only been more numerous but more destructive. For every million acres of standing timber within the boundaries of national forests in the West, 145 acres have been burned, as compared with 98 acres to the same date in 1939 and the five-year average of 78 acres. The situation in the East is even more serious: 694 acres per million thus far this year as against 375 for the same period last year and five-year average of 535.

The most serious situation obtains in the Great Basin regions, including southern Idaho. The flashed report from this region reads, "Emergency conditions Idaho, becoming general elsewhere." For the region immediately to the north, which takes in the forests of the northern Rockies generally, the word is, "Approaching critical. Outlook very unfavorable." Only from the moister states of Oregon and Washington have foresters been able to report, "Weather somewhat more favorable."

ITEMS

ULTRA-HIGH frequency radio waves were successfully used in two-way communication over a considerable distance for the first time in experiments by the Mount Washington Observatory staff. Using a frequency of 225 megacycles, or about 1.3 meters, communication was established at a distance of 90 miles. Hitherto two-way ultra-high frequency radio has been limited to a few miles only. In the present experiments both voice and code were satisfactorily transmitted.

PRODUCTION of one of the most useful of the artificial rubbers, which is more resistant to oils and solvents used in industry than natural rubber, will be increased with larger yield of acrylonitrile, a chemical essential in its manufacture. B. W. Henderson, manager of the Rubber and Rubber Chemicals Division of the American Cyanamid and Chemical Company, announces that its output of acrylonitrile had been doubled and that further increases are expected as the demand grows. Acrylonitrile is derived from cyanamide. It is combined with butadiene, a petroleum product, in the manufacture of artificial rubber.

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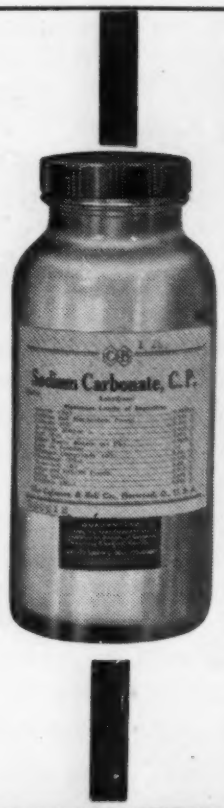

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SCIENCE NEWS

Science Service, Washington, D. C.

ENERGY FROM SPLIT URANIUM ATOM

THE minute amount of energy released by the splitting of an atom of power-producing Uranium 235 was used in Boston on July 24 to turn on the new fifty kilowatt transmitter of Westinghouse radio station WBZ.

Uranium, a heavy brittle metal, exists like other elements in several forms, or "isotopes." The one of atomic weight 235 has recently been isolated in microscopic amounts. Studies made at several laboratories have led to the suggestion that if large quantities of U–235 could be secured, the world might have a practicable source of atomic power, which has long been sought.

The switchover from the present station in Millis to the new one at Hull, across the harbor from Boston, took place during a 30-minute broadcast over the NBC-Blue network, beginning at 8:30 P.M., Eastern Standard Time. Apparatus for the atom-splitting experiment was at Hull, and was under the control of Dr. E. U. Condon, associate director of the Westinghouse research laboratories at East Pittsburgh, Pa.

The splitting of the atom was heard by the radio audience as a sharp click. After two preliminary splittings, to acquaint listeners with the sound, the third one operated relays to switch from Millis to Hull. Those listening to WBZ, it is stated, noticed a new surge of power, and many more people were brought within easy hearing distance.

Dr. Condon explained the operation of the atomic power device as follows: "Neutrons (neutral atomic particles) from a mixture of radium and beryllium will be slowed down in passing through a coating of paraffin and will then strike a small target of uranium. One atom in 140 of the uranium will be in the form known as U–235. About once in every 10 seconds a slow neutron will hit the nucleus, or heart, of a U–235 atom and shatter it into five parts—two new atoms of different elements and three neutrons. As these fragments fly apart with an energy of 200,000,000 electron-volts, they will ionize (electrify) the air in the apparatus and permit a small electric current to flow through a circuit. Following an amplification of about a million times, the current will be strong enough to trip a thyratron tube which in turn will operate a relay to switch on the new transmitter."

The increased strength of the new station does not come from increased power, for this is the same (50 kilowatts) as the old one. According to Vincent F. Callahan, general manager of WBZ, it is due to the directing antenna. This reflects waves that would otherwise be wasted over the Atlantic Ocean and sends them back to reenforce those supplying the densely populated area around Boston. It consists of two 500-foot towers, one of which is the director, and the other the reflector. Located on the salt marsh of Hingham Bay, it takes advantage of the ideal properties of salt water in carrying ground waves.

RADIO COMPASSES

Two crossed white lines on a map indicate to an airplane pilot his exact position, with a new invention which has just received U. S. Patent 2,209,191. The inventor is John B. Dearing, of Ben Avon, Pa.

Radio compasses previously used on airplanes and ships give in numbers the direction, or "bearing," of a selected transmitting station. Thus, the pilot can find the direction of two separate stations whose positions are known, mark these on a map as lines passing through the locations of the transmitters. The intersection of these lines is the position of the aircraft.

To do this automatically is the purpose of Mr. Dearing's invention, the patent rights of which have been assigned to the Radio Corporation of America. Two radio receivers tune in the two stations, on a loop antenna, which responds best when the station is in the plane of the loop. The antenna rotates, and as it does so the intensity of the signal varies in strength.

The receivers control two beams of cathode rays, in a vacuum tube, which fall on a screen similar to that used in television receivers. The beams oscillate back and forth, tracing out two lines on the screen, and the direction of the lines depends on the bearings of the stations. By a small magic lantern incorporated into the device, a map is projected from a film on the same screen. Thus, the pilot sees the map, with the two bright lines, superimposed. Their intersection shows his location, which changes as he flies along.

In order to keep the map and screen properly oriented, regardless of the direction of flight, the entire indicating mechanism is rotated under the control of a gyro compass on the ship. This keeps north, for example, at the top at all times.

SUMMER HIGH TEMPERATURE

THE sun's light and heat rays are not as concentrated in July as they were at the time of the summer solstice, June 21. It is quite all right to feel hot, nevertheless. This is the time of year when normal temperatures are highest, according to the weather men.

On June 21, the summer solstice, the sun was farthest north. Then, in countries on this side of the tropics, it was highest in the sky and its heat and light rays alike were falling on the ground most nearly vertically. Therefore, they were most concentrated. Their heating effect was greatest.

Yet the summer solstice was not the hottest time of year. Here's why! All day long, the rays beat on the earth, and it becomes hotter. All night long, if it is clear, the earth radiates this heat out again into space. In June, with long days and short nights, the amount of heat taken in during the long day was considerably more than that given off during the short night.

Even after the solstice this condition continued, despite the fact that the sun moved southward in the sky, and its rays, falling on the ground at a lower angle, were less concentrated. Thus the temperature of the earth continued to rise. Not until July or August is there a balance, with amount of heat radiated at night the same as

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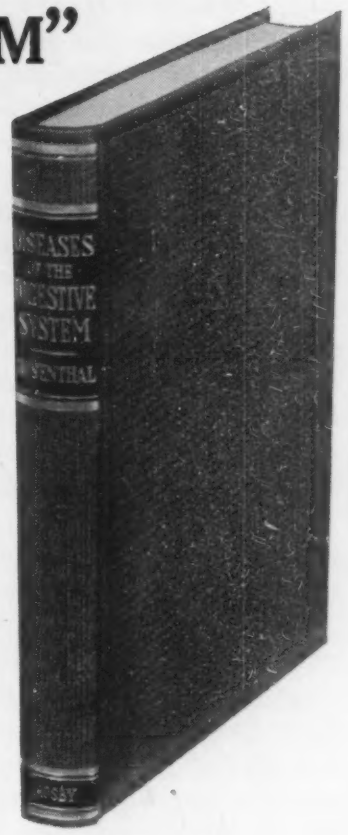

This new book deals with that branch of internal medicine which embraces the pathology, diagnosis and treatment of the digestive organs. The book was written for the general practitioner, covering the common disorders encountered in a general practice, and presenting a picture which can be applied to the patient. Dr. Rosenthal urges consideration of the patient as a whole rather than the focusing of attention on the pathology of the one particular organ.

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that received during the day. After that, the nocturnal radiation is greatest, and average temperatures begin to drop.

Local conditions, naturally, affect this. If there happens to be a series of hot days and cloudy nights, the heat becomes greater than ever, because clouds blanket the earth, and reduce the nightly cooling. Most to be desired are cloudy days and clear nights. The former reduce the heat received from the sun, while the latter permit the heat to escape as usual.

Edward H. Bowie, in charge of the U. S. Weather Bureau at San Francisco, has made a study of the delay in hottest weather in various parts of the country. This shows that in southern Arizona and New Mexico, highest normal daily temperatures come only ten days after the solstice. Around the coast of the Gulf of Mexico, the delay is 40 to 50 days. Along the North Atlantic Coast it is about 40 days, but about a hundred miles inland it is only 30 days. In the central states it is about 30 days.

Along the Pacific Coast, the delay is greatest, about a hundred days at San Francisco, but this lag drops very rapidly away from the ocean. At Sacramento, less than 100 miles inland, it is 37 days. Dr. Edgar W. Woolard, of the U. S. Weather Bureau, who has carefully studied these time lags, attributes the great delay to the prevailing westerly winds that blow in from the cool ocean surface. The proximity of water along the Gulf and North Atlantic coasts makes the delay greater than in the dry southwest. Dr. Woolard states, however, that not all the delays are fully explained.

It is on account of these facts that the summer solstice on June 21, when the sun is farthest north, is considered the beginning of summer rather than its middle. If temperatures depended solely upon the sun, it would be just as hot a month before the solstice as a month after it. In reality, the warmest weather arrives some time after the solstice, so the highest temperatures come approximately in the middle of the three months following the solstice.

THE ZINC PEROXIDE TREATMENT FOR CANCER

Success in treating ulcers or sores in 35 cancer patients whose condition was so bad they had been given up as hopeless is reported by Dr. Bromley S. Freeman, of the Tumor Clinic at the Veterans Administration Facility, Hines, Ill., in the current issue of the *Journal* of the American Medical Association. The treatment consisted in using zinc peroxide for dressings on the sores and as a mouth wash in some cases of lip and mouth cancers.

The ulcers or sores had followed x-ray or radium treatment for cancer, which in some cases had persisted. Persistence of the cancer after the radium or x-ray treatment was in some cases hidden by the infection in the ulcers. After the zinc peroxide treatment cleaned up the ulcers, it was possible to give more irradiation for the cancerous condition and in some of the cases reported the patients have advanced to the stage where plastic operations can be done to restore bone and other tissue destroyed by the first treatments.

The zinc peroxide treatments relieved pain to the extent that most of the patients could get along with only mild sedatives instead of the morphine or other narcotics they had previously required. The odor from these sores, so bad that patients in the next ward complained about it, grew definitely less, in all but one case, starting within twenty-four hours after the first application of the zinc peroxide.

"Freedom from embarrassment and the return to normal social contacts and interests together with newly acquired confidence and hope have been noted uniformly," Dr. Freeman states in his report of the patients' condition after the treatment. He is now using the zinc peroxide prophylactically to prevent or lessen the frequency or degree of bone destruction following x-ray or radium treatment of cancer of the mucous membrane. The treatment is for cancers, or sores following their irradiation treatment, occurring on the surface of the body. Among cases reported were those where the ulcers were on the jaw, throat or mouth.

Zinc peroxide is effective in the treatment apparently because when suspended in distilled water it sets free oxygen which destroys certain germs, among them the kinds Dr. Freeman found most frequently in the sores of the advanced cancer patients. He states that after disappointing results with other products, he is using only the special medicinal brand of zinc peroxide.

THE DIET OF GOLF PLAYERS

GOLFERS, especially poor players, who get tired and begin to pile up a high score between the ninth and fifteenth holes in a foursome or between the eleventh and the fifteenth in a twosome are advised to eat more fat foods for lunch and take some sugar or candy near the seventh or ninth hole. This advice comes from Dr. Paul Michael, of Oakland, Calif., in a report to the current *Journal* of the American Medical Association.

The idea comes from previous findings that marathon runners who are sustained by sugar come through a race with less fatigue. Comparatively few persons run in marathons or other races, but more than 2,000,000 golfers play on 3,000 courses in the United States, so Dr. Michael decided to investigate the possibilities of helping this large group of sportsmen and women through diet studies.

Blood tests showed that following usual luncheons and playing under ordinary conditions, the sugar in the golfers' blood dropped below normal between the ninth and fifteenth holes in a foursome and between the eleventh and fifteenth holes in a twosome. This corresponds to the periods when the golfers made the greatest number of poor shots, felt most tired and had the highest scores.

The poorer golfers had even less sugar in their blood in many cases "because of the fact that they expended more energy in playing the game and showed greater signs of exhaustion." Getting upset over their poor shots at this period made the condition worse. The more composed and accomplished players did not have as low a level of sugar in their blood.

When the golfers ate more fat foods for lunch and took candy or sugar at the seventh or ninth hole, they did not feel so tired or nervous and, on the whole, had better scores.

BONY GROWTHS ON THE JAW

DR. ALEŠ HRDLIČKA, of the Smithsonian Institution, has been making a study of about 5,000 lower jawbones of the collection at the institution of ancient and modern skulls, and finds bony outgrowths from the inner jaw surfaces fairly frequent, and widespread in both space and time. Some of these growths are tuberculate ("lumpy"), others are ridges. They are almost like bony tumors, except that the bone appears to be strong and perfectly healthy.

The first suggestion, that these growths represent an evolutionary "throwback," is set aside because ancient human and pre-human skulls do not show them. They are not found on Neandertal jaws or on the jaws of fossil or existing great apes. They appear only on jawbones of modern man, and are slightly more frequent in men than women.

The most plausible explanation is that the growths are responses to muscular pull on the bones, due to chewing hard on tough, resistant foods. Especially significant is their relatively high frequency among the Eskimos. Also, they were more common on the jaws of early Norse settlers in Iceland and Greenland than they were in the Scandinavian homeland.

Asked about possibilities of results from the modern habit of gum-chewing, Dr. Hrdlička stated, "That question may not be as frivolous as it sounds. True, gum isn't tough, and it requires very little exertion to chew it. But the advanced gum addict chews and chews and chews, hours on end sometimes, so that the sum total of exertion on the part of the jaw muscles may easily amount to as much as a smaller number of harder bites on a tougher substance.

ITEMS

MRS. AGNES CHASE, who was loaned to Venezuela by the Smithsonian Institution, has returned after spending two months in the field as guest of the government. The grass problem in Venezuela is very much like that of our own Plains region: to find suitable species, native or imported, that can be used to greatest advantage in redeveloping its drought-afflicted, windswept rangelands, so that they may again become able to support great herds of cattle and flocks of sheep and goats. Mrs. Chase recommends that a Venezuelan botanist be sent to the United States for advanced studies that will enable him to continue the work she initiated.

CAMELS that once roamed the dry grasslands that are now rock strata beneath the soil of South Dakota are represented in fossil collections sent back to the Field Museum of Natural History by an expedition under the leadership of Paul O. McGrew. The camels lived in America during Miocene time, about 18 million years ago. They later became extinct in North America, but unlike primitive horses they still have surviving relatives native in South America. Mr. McGrew's search for fossils has been conducted largely in the vicinity of Wounded Knee. The party has now moved on to northwestern Nebraska.

FURTHER details are awaited before the reports from Switzerland that Dr. Walter Minder, of the Radium Institute at Berne, Switzerland, has discovered the missing chemical element 85 can be accepted. Several times in the past decade similar announcements have been made, but further research failed to confirm them. In 1930 Dr. Fred Allison, at the Alabama Polytechnic Institute, announced that he had found evidence of both 85 and 87 in certain minerals by a method using magnetic and optical principles in combination. However, others found themselves unable to duplicate his results. In 1931 Dr. Jacob Papish, of Cornell University, also announced the discovery of 87, but by different methods. This, also, is still unaccepted by the scientific world in general. However, recent work at the University of California in bombarding elements with neutrons, it has been claimed, has created extremely minute amounts of 87. Dr. Minder, supposed discoverer of 85, is known for a paper he published in 1938 on theoretical aspects of the disintegration of radium and similar elements. In this he made a suggestion that under certain conditions, 85 and 87 might be formed. The paper does not, however, give any clue to the methods that he might have used to detect and isolate it.

How much variation there may be in the same species of deer is brought out strikingly in a new publication of the Smithsonian Institution, in which ten distinct subspecies of the white-tailed deer are described by Dr. Remington Kellogg, of the U. S. National Museum, and Major E. A. Goldman, of the U. S. Biological Survey. Although the white-tailed deer is commonly called the Virginia deer, it is found practically all over the United States and in Mexico and Canada as well. Some of its variations in size, color, antler form, etc., have become so well stabilized in isolated places like mountain areas and off-coast islands that they are recognizable as distinct subspecies.

A WORKING model of the new 200-inch telescope being erected by the California Institute of Technology on Mount Palomar, one tenth the size of the original, and built at a cost of $25,000, has been placed on display at the Golden Gate Exposition. The model, with its 20-inch mirror and all necessary auxiliary attachments, is a complete telescope, and has been used for more than a year in actual observations. The model is part of the exhibit of the Westinghouse Electric and Manufacturing Company, which built the mounting for the telescope itself. Weighing about a million pounds, it is now in place in southern California, but will not be used until the completion of the 17-foot concave mirror which will gather the rays of starlight.

DR. IAN MCTAGGART COWEN, of the Provincial Museum at Victoria, B. C., reports in the *Journal of Wildlife Management* that cancer is attacking the grouse in British Columbia. Specimens of grouse with some unknown but apparently malignant growth on their heads, threatening to make their eyes useless, were brought in by hunters. Microscopic examinations of tissue sections were made by Dr. G. A. McCurdy, pathologist of the Royal Jubilee Hospital. He diagnosed the growths as "low grade papillary carcinomata." Dr. Cowan states that "The presence of this disease in epidemic proportions in a localized area suggests that it is contagious. It seems probable that the causative organism is a filterable virus and that transmission is by biting flies."

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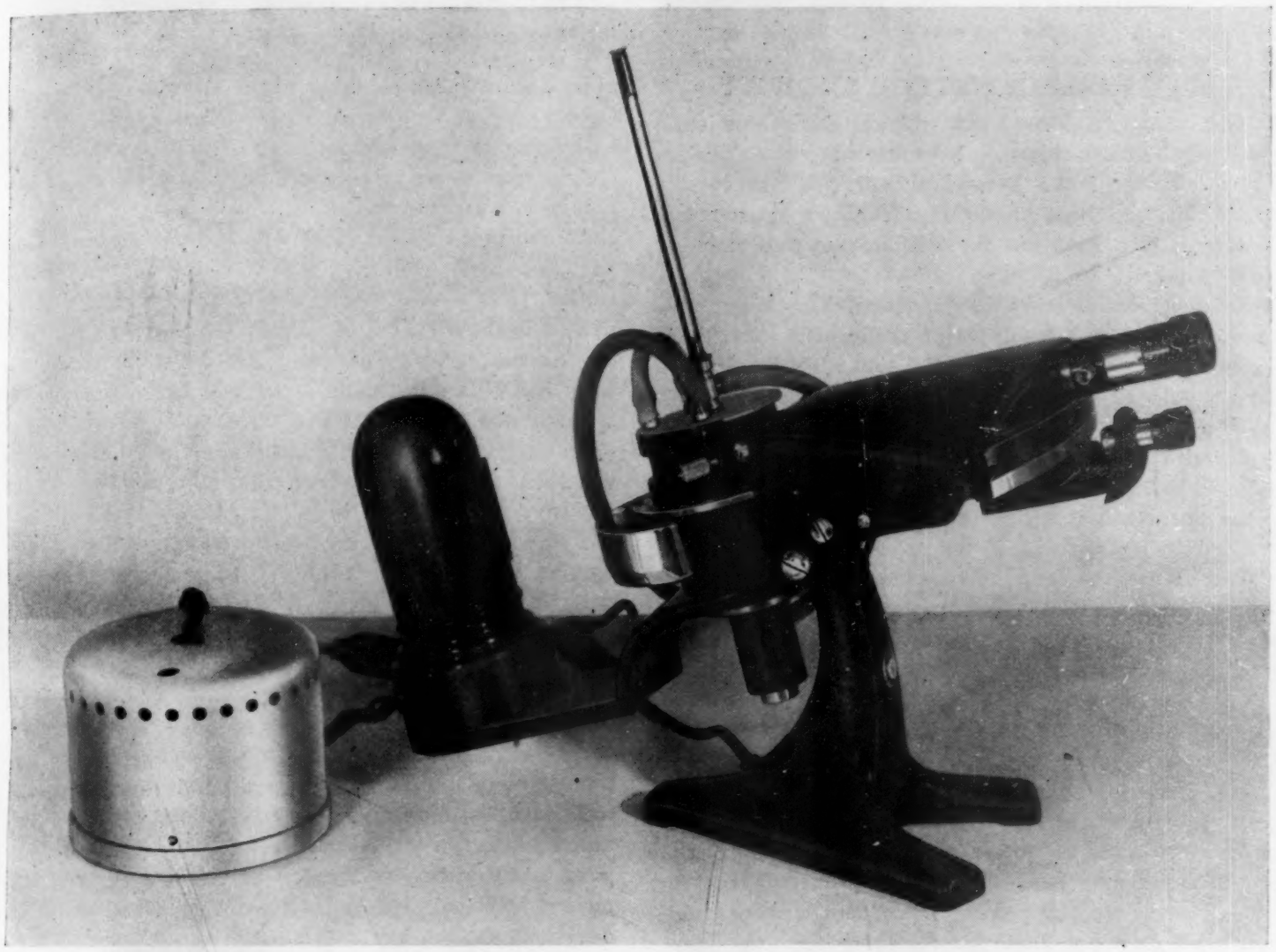

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PERSEID METEOR SHOWER

MANY amateur astronomers will aid the professionals who study meteors this month by watching the skies for shooting stars of the Perseid shower. They come in largest numbers about August 11, though the entire month of August is a good one in which to see these missiles from space.

These meteors are tiny things, generally no larger than grains of sand, yet hundreds of millions of them reach the earth's atmosphere daily. Friction with the air heats them to such an extent that they burn in a flash of light, called a "shooting star." Of course, they have nothing to do with the stars, as the ordinary meteor is visible while 50 to 75 miles above the ground.

Meteors seen ordinarily are sporadic, but there are several definite swarms which move around the sun in regular orbits. When the earth crosses one of these swarms, as it does about August 11, meteors are far more numerous. Then one a minute, or even more, is visible. Sporadic ones may come from any part of the sky, but those of the showers appear to radiate from a single direction. This is an effect of perspective. Actually, the meteors are moving in parallel paths, and these converge, like railroad tracks, in the distance.

In the case of the August meteors, this convergence is in the direction of the constellation of Perseus, which rises late in the evening to the northeast. Therefore, they are called Perseid meteors. Meteors are always more numerous after midnight than before, since then we are on the advancing side of the earth, and meet them head-on. During the evening only those which can catch up to us are visible.

Dr. Charles P. Olivier, director of the Flower Observatory of the University of Pennsylvania, at Highland Park, is one of the leading authorities on the subject, and is always glad to receive reports of amateur observations. A useful, yet simple, observation is to count those seen over half-hourly periods, as from midnight to 12: 30, 12: 30 to 1: 00, 1: 00 to 1: 30, etc. The times of any particularly brilliant meteors should be noted, and this information, together with an accurate statement of the observer's position, should be sent to Dr. Olivier.

Observers are especially favored this year because the moon will be just past first quarter on the eleventh, setting about midnight. Thus, its glare will not interfere, as it would if it were full at the time.

JUPITER AND SATURN

THE beginning of a rare and complicated step in the movements of the planets, during which Jupiter will pass Saturn three times in six months, will occur on August 15. The last time such a maneuver was seen was in 1682 and 1683.

Astronomers call this a "triple conjunction." It is an effect of the motion of the earth around the sun, at a speed of 18.5 miles per second. Jupiter, farther out from the sun, travels more slowly, only eight miles per second, while Saturn plods along at about six miles per second. Once a year, as we overtake these planets, they seem to go backwards, or "retrograde," in the same way that a slow freight train seems to be going backwards when you pass it in a fast express.

At the present time, both Jupiter and Saturn, which rise soon after midnight, are traveling in their direct motion, from west to east. Now Jupiter, brighter of the pair, is to the west, but on August 15, at 8: 00 A.M., Eastern Standard Time, he will pass his fainter brother. They will be separated by about two and half times the apparent diameter of the full moon.

On August 27, as the earth catches up to Jupiter, he will seem to stop, after that will retrograde, moving to the west. On September 4, Saturn likewise will stop, and turn back. Then, on October 11, Jupiter will again pass Saturn.

By December 31, we will have moved far enough along that Jupiter will again seem to stand still, and then start moving east once more. After January 10, Saturn will resume his direct motion. On February 20 the third, and final, conjunction of the series will take place. In the fall of 1941, the two planets will again move to the west, but this time, Jupiter will not reach Saturn.

About nineteen years from now, Jupiter will again pass Saturn, but then only once. While the planets will retrograde at that time, as they do every year, this backward motion will not occur at the right time to cause a triple conjunction.

A famous triple conjunction occurred in 7 and 6 B.C., about the time of the birth of Christ. It has been suggested that this was one of the strange happenings in the sky observed by the Wise Men, that have come down to us as the "Star of Bethlehem."

THE ROTATION OF THE MILKY WAY

PHOTOGRAPHS made over a four-year period beginning in the year 2015 will be required to complete a research program to measure the rotation of the Milky Way, which will start soon at the Lick Observatory of the University of California.

A new $65,000 star camera, making exposures on plates 17 inches square, will be used, according to Dr. W. H. Wright, director of the observatory. The 16-ton mounting for the camera, arranged to turn as exposures are made, thus compensating for the earth's movement, is now in place. Eventually it will have two lenses, one to photograph in blue and ultra-violet light, the other in yellow light.

However, the European war will delay indefinitely the completion of the former, since the glass discs of which it is ground were ordered from abroad. The glass for the latter arrived just before hostilities began, and is being ground to the right curvature. For the present this one will do double duty.

Every clear night, after the lens is in place, photographs will be made, overlapping pictures of the northern part of

the heavens. Four years, it is estimated, will be required to complete the work. Seventy-five years from now, the series will be repeated, and comparison of the two sets of plates will show the rotation of the Milky Way.

The sun, as well as the stars we see, is part of the Milky Way system, or Galaxy, and partakes of this rotation. These stars are arranged in a great cluster the shape of a grindstone. We are inside, when we look to the edge of the grindstone, we see a much greater concentration of stars than when we look to the side. This concentration is the Milky Way. The grindstone is about 100,000 light years (600,000,000,000,000,000 miles) in diameter.

Stars nearest the center turn fastest. We are about two thirds of the way out from the center, and at that distance take about 220,000,000 years to make one circuit. Long though this is, the distance is so great that we are traveling at a speed of approximately 170 miles per second to make it. These figures will be known much more accurately in 2019, when the Lick Observatory program is completed.

Incidentally, the new star camera has many other uses, and will not be placed in retirement in the interval.

CHRONOMETERS FOR THE NAVY

SHORTAGE of chronometers—accurate marine timekeepers—which has led the U. S. Navy to reduce the number on battleships from the usual three to two, is not as serious as it might have been at the time of the last war.

Radio time signals in recent years have increased both in accuracy and number to such an extent that a navigator could now operate satisfactorily with no timepiece but a dollar watch. Twenty times a day, on a number of different frequencies, signals are broadcast from the powerful Navy radio stations at Arlington, Virginia, Mare Island, California, and other locations. Thus, even a relatively poor clock or watch can be checked frequently and its error determined.

These time signals originate at the Naval Observatory, whose superintendent, Captain J. F. Hellweg, invented the transmitting clock which has made possible such accurate time signals, usually precise to within a hundredth of a second or less. This clock can very rapidly be checked and set by comparison with the standard clocks, kept in an underground vault at constant temperature and pressure. The actual transmission is controlled by a vibrating quartz crystal, similar to those used to keep radio stations operating on the proper wave lengths. Similar clocks, adjusted by the signals from Arlington, are used at distant stations.

Though many chronometers have been imported from England, Switzerland and Germany, good ones are also made in the United States. There are many in private hands, and, if the shortage became serious, these could doubtless be obtained by the government.

The chronometer is needed to find a ship's longitude. Latitude can be found by observing with a sextant the sun's height when it has its greatest altitude—that is, at "high noon." But to get the longitude, the navigator must find his local time and compare this with the time at some fixed point, usually Greenwich, the British national observatory. If he is west of Greenwich, his time is earlier, if east, it is later. The difference tells him the distance he is east or west.

Chronometers carry Greenwich time, and the local time can be found by astronomical observations in one of several ways. Most ships in the past have carried three chronometers. If there were only one, it might stop. With two, an awkward situation might arise if they differed, for no one could tell which was correct. But with three there is greater safety, for not more than one is likely to be seriously in error at a time.—JAMES STOKLEY.

THE DANDRUFF GERM

(Copyright, 1940, by Science Service)

THE mystery of the cause of human dandruff is still unsolved, despite the willingness of an investigator of the United States Public Health Service to allow suspected germs to be rubbed on his scalp.

With a Scotch verdict of "not proven," the indicated fungus, *Pityrosporum ovale,* is relieved of some of its suspicion. It is concluded that it is due "to a somewhat abnormal physiolog' ıl condition."

The tests were made by Dr. C. W. Emmons, of the U. S. Public Health Service. The experiment was made on a staff member of the National Institute of Health. He took a chance on getting worse dandruff than he already had by rubbing the suspected germs into his thoroughly cleansed scalp and shoulders. And he did this not just once, but many times. No dandruff scales appeared on his shoulders. Dandruff did not appear any sooner on the parts of his scalp where the germ had been rubbed than on other parts that had been cleansed and left alone as control areas.

The reason for using a dandruff victim for the tests was that the suspected germ is almost universally present on the human scalp, with or without dandruff. The tests had to be made on someone known to be susceptible to dandruff.

The germ which has long been suspected of playing a part in causing dandruff, because it is found on dandruffy scalps, is a fungus named *Pityrosporum ovale.* Pitiful may describe the condition of scalps on which *Pityrosporum* is found, but the fungus gets its name from a Greek word meaning "bran." It also travels under the alias of "bottle bacillus," which again may be somewhat misleading to the layman. It is merely descriptive of the shape of the fungus, and has nothing to do with any bibulous proclivities on the part of either the fungus or its victim.

The drinking habits of the "bottle bacillus" are unrecorded, but its food habits are known. This is what led Dr. Emmons to his investigations. Not until he had found the fatty diet that the fungus would thrive on did he turn to the question of its relation to dandruff. He still says that more proof is needed before one can be sure that this fungus is not the cause of dandruff.

THE NETHERLANDS INDIES

THE Netherlands Indies have been quite unevenly developed by their present owners. Although Java is only fourth in area it is far and away first in development,

with plantations climbing terraces to the very mountain-tops, a huge and hard-working native population, and vast wealth in its highly organized and diversified export trade.

Jack Shepard points out in the current number of the *Far Eastern Survey* that, compared with Java, the other islands in this great archipelago-empire seem backward and neglected. This seeming neglect is not real, however, Mr. Shepard adds, and the lower state of development of the other islands has good and sufficient causes.

None of the other islands is as blessed as Java with wide stretches of rich soil, easy access to the sea, and a large population of willing brown workers. The Dutch-held parts of Borneo and New Guinea, for example, consist largely of rugged, jungle-covered interior uplands surrounded by vast swamps that run down to the sea in impenetrable growths of mangrove. The famed Spice Islands, hotly fought over by Dutch and Portuguese in the sixteenth and seventeenth centuries, have soils so poor and thin that general farming, to support real working populations, is out of the question. In many of the islands, especially the larger ones, the natives are so primitive, and frequently so shy or even hostile, that they could never be trained to plantation work.

Oil is the key product of the "neglected" Outer Islands, as the Netherlands Indies outside Java are called. There is oil on Sumatra, Borneo, New Guinea, Ceram and possibly other islands. Oil is now the chief export of the Netherlands Indies.

Rubber ranks second among the islands' sources of wealth. Greatest rubber plantations are on Java, of course, with Sumatra coming second. There is a very considerable development of small, native-owned rubber plantations in the Outer Islands. More than two thirds of the rubber acreage in these provinces is in the hands of native growers, many of whom are quite modern in their cultivation methods and marketing arrangements.

Tin is an important product, but limited in its occurrence. The entire output of this strategically vital raw material comes from the small islands of Banka, Billiton and Singkep, off the east coast of Sumatra.

ITEMS

EMPHASIZING that good health and high intelligence will make refugee children from England more desirable temporary American residents, the American Eugenics Society, Rudolf C. Bertheau, secretary, is asking its membership throughout the country to give careful consideration to becoming foster parents to such children selected eugenically. "The advantageous eugenic implications of the presence of these children in our midst, even if only for the duration of the war, will depend largely on the physical and mental status of the children. The Eugenic Societies of Canada and Great Britain are taking an active part in this movement. We may feel reasonably assured that eugenic standards will be maintained to whatever degree the American foster parents desire."

THE head-on collision near Akron, Ohio, of a gasoline rail car with a freight train, causing more than forty deaths, calls attention to the fact that less than half of the nation's passenger rail trackage is equipped with automatic block signals. Data indicate that the stretch where the collision occurred did not have the automatic signals, but used manually operated ones. Automatic block signals indicate some distance away whether a train is in a certain block. It is too early to tell whether these would have prevented the Akron wreck, but it seems likely that they would have done so.

JOURNEYING by rocket to the moon, to see the earth eclipse the sun on April 15, 2033, will be the experience of visitors to the Fels Planetarium, Philadelphia, during August, according to F. Wagner Schlesinger, director of the planetarium. The planetarium chamber will seemingly be transformed into a rocket ship, and, as the trip is made, the moon will be seen growing larger and larger. Arriving there, visitors will disembark and see the earth hanging in the sky above the lunar mountains. It will change in phase, as the moon does from the earth. Then, at new earth, the sun will pass behind our planet. The moon will be illuminated with a strange red glow, from a ring of ruddy light around the earth. After a three-week period on the moon, compressed into forty-five minutes, the voyagers will be safely returned to earth.

WITH 1,700 reindeer born this year, Canada's reindeer herds in the western Arctic now number about 6,600 animals. When five years ago reindeer reached Canada's western Arctic after an overland trip lasting five years from the west coast of Alaska, there were 2,370 animals in the herd which had made the trying trip. Since then the herds in the Mackenzie River district have increased annually to the present total. The reindeer were imported into Canada to provide a new Eskimo industry, because the caribou on which the Eskimos had counted largely for food had been driven away with the onward march of civilization to the north. Eskimos have been trained as reindeer herders, and this autumn the second herd will be given to an Eskimo to look after. This will be a herd of 800 animals which will be driven 250 miles overland from the main reindeer herd to the Horton River district.

THE cure of bubonic plague by chemical remedies of the sulfanilamide group is expected as a result of successful experiments with plague-susceptible mice. The experiments, made by Dr. S. S. Sokhey, director, and Dr. B. B. Dikshit, pharmacologist, of the Haffkine Institute, Bombay, India, are reported in *The Lancet*. One of these remedies, sulfathiazole, saved 80 per cent. and 90 per cent. of plague-stricken mice after the disease had reached the most dangerous stage, when the germs had invaded the blood stream. Even better curative results are hoped for when sulfathiazole is used to treat human beings because the disease is much more severe in mice than in men. Sulfathiazole proved, in mouse plague, to be more effective than sulfapyridine or other of the sulfanilamide group of chemical remedies. Results of treatment with sulfathiazole are as good as those obtained with the Haffkine Institute anti-plague serum.

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SCIENCE NEWS

Science Service, Washington, D. C.

INFLUENZA VACCINE

THE first extensive human trials of a vaccine against influenza developed in the Rockefeller Foundation's International Health Division laboratories are being conducted in Puerto Rico during the epidemic now subsiding there. Volunteers are being given the injections which it is hoped will protect against the disease. Made from the virus grown upon chick embryos, the vaccine is administered by injecting under the skin. The extensive epidemic of influenza in Puerto Rico presented the first real opportunity of testing the Rockefeller vaccine.

Any doubt that the Puerto Rico outbreak is real influenza was dissipated when field investigations demonstrated that the virus of this outbreak is the same as that identified by the group of British investigators who first isolated the influenza virus—Drs. W. Smith, C. H. Andrewes and P. P. Laidlaw.

An intensive investigational attack is being made upon the Puerto Rico outbreak by the Rockefeller Institute, cooperating with other investigators. Dr. Edwin H. Lennette and Dr. E. R. Richard, of the laboratories of the Rockefeller International Health Board in New York, went to the scene of the outbreak. There they are working closely with Dr. John W. Oliphant, of the U. S. Public Health Service, who was sent from Washington. Dr. P. J. Crawford and Dr. H. P. Carr, of the Rockefeller Institute, who are regularly stationed at Havana, are also working on the influenza situation in the West Indies.

In the New York laboratories of the International Health Board of the institute, Dr. F. L. Horsfall, Jr., is carrying on laboratory researches on material sent from Puerto Rico and continuing with his colleagues the intensive investigation of the disease.

Predictions about the further course of the epidemic now subsiding in Puerto Rico are hazardous, but authorities are apprehensive that the disease may spread to the mainland of the United States.

The epidemic is reported to have reached St. Thomas, Virgin Islands, on July 19, Cuba on August 2 and the Dominican Republic on August 7. Since medical science is very much in the dark about just how the disease is spread, no effective steps can be taken to prevent its transmission to other parts of the western hemisphere. Probably it can be transmitted by those who are only slightly ill or harboring the virus while well. The complete stoppage of all travel from boat, airplane or any other means would be necessary for any effective barrier, and this is impracticable.

Whether the epidemic will reach the United States and whether it will become serious in proportions can not now be predicted. The investigators are anxious that the public shall not become alarmed at any such prospect. The historical record does show that some of the influenza epidemics of the past have had their origin in the Caribbean region. The outbreak of 1934 was one of these.

If influenza does strike the United States the epidemic is not expected to be on the order of the famous one of 1918. About 3 per cent. of the people of Puerto Rico were ill in the present outbreak, but only about a third of one per cent. of those taken ill died.—WATSON DAVIS.

THE DEATH RATE OF CHILDREN

ABOUT three out of every four children born now will die from chronic disease, while acute disease will take about one in six, according to a bulletin issued by the statistical department of the Metropolitan Life Insurance Company. This represents a considerable change from conditions at the beginning of the century. Every third child born then would have been killed by acute disease, while chronic disease would have been responsible for the deaths of about half the group.

Childhood ages have chiefly benefited by the cut in death rate from acute and infectious diseases. On the other hand, most of the chronic diseases, which have their greatest incidence in mid-life and in old age, have shown little or no improvement, and in some cases there have been actual increases in their mortality rates. Of the chronic diseases, tuberculosis is the only one of importance that has shown any marked improvement.

The data also bring out the fact that "external causes," which include deaths by suicide, homicide and accident, have greatly increased in importance since 1920, especially for males. In 1901 77 in a thousand males would have died in this way, in 1920 this had increased to 79, but in 1937 it stood at 101. The corresponding figures for females were 33, 38 and 56 in a thousand. Other figures collected, comparing deaths during the first half of 1939 and of 1940, show that the depression years did not adversely affect the health of the nation.

Early in the thirties, it is stated, "it was feared that the most severe industrial depression of a generation would be quickly reflected in an increased death rate. When this did not happen and when indeed each year, without exception, registered a more favorable mortality rate than had prevailed in any year during the '20's,' many health workers still feared that the ill effects on the public health were merely postponed, and that a rise in the death rate would come well before the close of the '30's.' This, again, did not happen, and the record new low rate of the current year, to date, is incontrovertible evidence that these fears were idle and may now be entirely dismissed."

The death rate per thousand, for those insured in the industrial department, was 8.98 in the first six months of 1939 and 8.14 in 1940.

THE ICE AGE

SOME 200,000,000 years ago the earth had a second moon, which broke into pieces. These formed a ring around our planet, like that now around Saturn. This shaded the equatorial regions of earth, cooling them sufficiently to cause tropical glaciers, in which ice flowed toward the poles. Such, in brief, is the theory proposed by Ronald L. Ives to explain the large areas of ice which, geologists have found, covered large areas in the tropics

during the Permian period. This lasted for about 30,000,000 years, ending around 190,000,000 years ago. The Ives theory is explained in a paper in the current issue of the *Journal* of the Franklin Institute.

Records have been found of four different ice ages, and three of them can be explained by a general cooling of the earth's surface. Such cooling has been caused, it is suggested, by increased volcanic activity, which threw large quantities of dust high into the atmosphere, where it screened the sun's rays from the earth as a whole. With world-wide temperatures reduced, the ice from the polar regions extended nearer to the tropics.

But evidence for glaciation in the Permian period has been found in and near the tropics, particularly India, central and South Africa, Australia and South America. There is also evidence that the ice at this time flowed away from the equator rather than toward it. To explain this geological mystery, Mr. Ives proposes that the earth once had a second moon, which he calls "Ephemeron." This, he thinks, was much smaller and nearer than the present moon, and revolved, approximately, over the equator. It may have been a minor planet, "captured" as it happened to approach the earth's gravitational field. Then, like the inner moon of Mars, it may have traveled around even faster than the planet revolved. Under these conditions, the same forces that cause tides would have pulled it nearer to earth.

Finally it would have come within about 12,000 miles, the "Roche limit"; it was so close that the tidal forces of the earth on Ephemeron would have shattered it into small pieces. These would continue to revolve around the earth, giving us a ring like that of Saturn's, which, it is supposed, had a similar origin. At last the ring would disintegrate. Continuing tidal action, as well as collisions of the pieces with each other, would gradually pull them down, causing a continual rain of particles into the atmosphere. "This, during nights in the early Permian, must have produced extremely spectacular meteoric effects, resembling a rain of fire in the upper atmosphere over the equatorial regions."

In the unknown period of time while the ring was in existence, it would have partially shaded from the sun's rays what are now the tropics, cooling them to such a low temperature that ice would have covered large areas. What are now the temperate regions would have been warmer, on the average, and the ice would have tended to flow in those directions.

As a test of his theory, Mr. Ives suggests that careful watch be kept of the rings of Saturn, which may be found gradually diminishing in size, then disappearing. It is also possible, he says, that Phobos, the inner moon of Mars, and the innermost one of Jupiter, may be eventually turned into rings.

"In the very distant future," he says, "as (and if) the solar system 'runs down,' earth may capture some wandering mass of cosmic junk and again acquire a ring like that postulated to explain the Permian glaciations. Speculation concerning the time of capture of this as yet unknown body is futile, for exact data, or even sufficiently detailed hypotheses, upon which to base the reasoning, are not now in existence. According to a number of theories, notably those of Jeffreys and Darwin, the moon will ultimately be drawn toward earth by tidal forces, and upon reaching the Roche limit will be broken up, the fragments forming a ring of small satellites about earth. This ring will probably produce such changes on earth that life in forms resembling the present will be impossible. Calculations suggest that this cataclysm will take place in about eight billion years, an interval about three times that from the 'creation' to the present."

SUBMARINE CANYONS

THAT reversible currents, changing direction every few hours, sweep in and out of deep submarine canyons off the southern California coast, has been discovered by Professor Francis P. Shepard, the University of Illinois geologist now working at the Scripps Institution of Oceanography at La Jolla. These currents apparently do something to keep the canyons from filling up with sand and silt, but they are not strong enough to account for the cutting of the canyons themselves.

Cause of the currents is still undetermined. They can hardly be tidal phenomena, for they reverse direction in anything from one to four hours, which has no discernible relation to tidal periodicity. Professor Shepard conjectures that they may result from great oceanic eddies.

The canyon floors have been found to be practically free from mud where the canyon heads extend into the coast or near to the coast. On the other hand, muddy sediments at least ten feet in thickness have been discovered in canyons which terminate at a distance of a mile or more from the shore. This may indicate that the currents, weak as they are, are effective in the case of canyons which approach the coast. More likely, however, landslides along these canyons produce the effects.

The origin of these submarine canyons continues to be a puzzle. They have the same shape and arrangement as canyons cut by rivers on land. Rounded gravel has been dredged up out of some of them, to depths as great as 3,000 feet. This again suggests river action, for it is hardly likely that wave action would shape stones into rounded forms at that depth. Finally, some of the canyons have deltas, like those formed by rivers, at their outer ends.

The great depth at which some of the canyons have been found is one obstacle to ready acceptance of the theory of their formation by rivers on land and subsequent drowning in the sea. Regarding this, Professor Shepard says: "It is interesting to note that canyons are found off all sorts of coast quite regardless of the type of rock, of the violence of storms, the width of continental shelf, etc. Nor do they show any relation to areas where the coasts are known to be unstable. This suggests but by no means proves that the sea level has been changing. However, the canyons extend so deep that it seems certain that if they are river-cut there must have been more than sea-level changes to account for them. My guess at present is that there has been a combination of processes of which sea-level change due to much larger polar ice caps than have been normally supposed is the major contributing factor. Sea-level

changes of 2,000 to 3,000 feet may set up great strains in the earth's crust due to redistribution of weight, and these strains may have caused emergence of the continental borders to a considerable degree. However, other factors no doubt combined to produce the curious submarine features.''

REPRODUCTION OF THE GLOSSY FINISH OF PERSIAN CRAFTSMEN

A GLOSSY finish that was the pride of Persian craftsmen 2,500 years ago has been restored to a plaster cast of an ancient lion's head sculpture by a few minutes of photographic ''developing'' at the University of Chicago. The process was used by Herbert P. Burtch, of the Oriental Institute.

The institute received from its Persepolis expedition fragmentary stone scraps of lions' heads. Pieced together, the fragments formed a magnificent snarling head in a plaster cast, but the cast was a dull, light color, instead of the original shining black of the effigy in ancient Persia.

Confronted with the problem of restoring the original gleam to the head, Mr. Burtch, after some experiments, hit upon the photographic process. The plaster cast was treated with silver nitrate, applied with a brush. Then it was ''exposed'' like a photographic plate or film, under a strong, even light.

The ''bathing'' process presented a difficulty, since the surface could not be touched without spoiling the appearance, but it was necessary to slosh the cast in water. A set of clamps and a metal standard provided the necessary purchase, but it took two men to ''bathe'' the head. Application of developer with a brush was the final step, and the product was a hard, glossy black, as pleasing as the stone original seen by the Persians two and one-half millenniums ago.

ITEMS

QUARANTINED at the National Zoological Park in Washington are beasts and birds which were brought back from Liberia by Dr. and Mrs. William M. Mann, who have been collecting new inhabitants for the Washington zoo during a several months' sojourn on the Firestone plantations in Liberia, with trips up country into the bush. Among the creatures in the fifty-odd crates brought ashore at the Army Base at Norfolk, Va., when the Barbour Line steamer *West Irmo* docked, are a pigmy hippopotamus, several chevrotain (miniature deer) and duiker (rabbit-sized antelopes), a number of monkey-eating eagles and a considerable miscellany of small mammals, birds and reptiles. The hoofed animals must be kept in quarantine for fifteen days because of the danger that they might introduce hoof-and-mouth disease, and all birds of the parrot family have to be kept under strict observation until they are proved free of parrot fever.

A GROUP of about fifteen amateur astronomers, members of the Amateur Astronomers Association, which has headquarters at the Hayden Planetarium in New York, will travel to Brazil to observe the total eclipse of the sun on October 1, according to an announcement made by Charles A. Federer, Jr., secretary of the association and editor of the magazine *Sky*, who will lead the party. The expedition will make observations from Campina Grande, at an altitude of 2,000 feet on the Borborema Plateau, and about 80 miles northwest of the city of Recife (formerly Pernambuco). Since the region is known for its long droughts, and September and October are excessively dry, there seems to be slight possibility of clouds interfering. Amateurs from other societies and their friends are invited to join the expedition and to participate in the program. George V. Plachy, chairman of the Committee on Special Events, is in charge of the detailed plans.

DISCOVERY of a new object that is probably a super nova, a vast stellar explosion, has been made by Dr. Josef J. Johnson, of the California Institute of Technology, with the 18-inch Schmidt telescope at the Observatory on Mt. Palomar. It occurred in a distant galaxy of stars, near the bowl of the Great Dipper in the northern sky. This is so faint that it is known only by its catalogue number, NGC 4545, and it is so distant that its light takes millions of years to reach us. Photographs taken at the end of July showed the object to be of the fifteenth magnitude, much too faint to be seen without a powerful telescope. A plate taken about two weeks earlier showed no trace of the explosion, though it would have been recorded had it been as bright as magnitude 17.5.

A NEW and cheaper method used in the search for trees afflicted with Dutch elm disease is described by W. E. Ahrens, of the U. S. Department of Agriculture, in the forthcoming issue of *Phytopathology*. It has the further advantage of being usable at any time of year, instead of only when the trees are in leaf, as at present. Mr. Ahrens's method depends on the fact that Dutch elm disease causes a marked discoloration of considerable areas in the sapwood, just beneath the bark. Samples of this wood, to a depth of from two to five annual rings, are obtained by driving in a half-inch hollow punch at six-inch intervals all around the trunk. The small wounds thus made are protected against other infections by squirting in a little paint, from a pump-type oilcan. The thin disks of wood are clipped in two, and if any of them show the discoloration symptom they are taken to the laboratory, where cultures show if the fungus is present.

A PROTEIN-DIGESTING enzyme, resembling pepsin in its action, has been found in the troublesome weed known as horse nettle or bull nettle by Dr. Davis M. Greenberg and Theodore Winnick, of the University of California. It is even more like the digestive compound found in the subtropical fruit papaya, known as papain, and because the weed's generic name is Solanum, the newly discovered substance has been given an analogous name, solanain. Papain has long been used as a medicine for indigestion, and it is regarded as possible that solanain may prove useful in the same way. It may also find economic application in tanning and other industries.

Published August 1940—

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The third edition of Holman and Robbins' "Elements" follows the organization and approach of the earlier editions. In this revision the material has been brought into accord with the most recent edition of the authors' famous "Textbook of General Botany," especially as regards factual material and illustrations. Ample space is given to applications and material of general interest; such data are set in smaller type to indicate that they are not the basic essentials of the course.

In the effort to bring the book completely up to date, many matters of current interest have been included. Among these subjects will be found:

The role of growth substances and their use in agricultural practice;

"Hydroponics" or water-culture methods of growing plants;

Root systems in relation to soil erosion;

Methods used in altering the duration of the life cycle of plants;

Artificial pollination;

Self-sterility in commercial fruit varieties;

Efficiency of certain plants in the production of carbohydrates;

Economic importance of plant diseases;

Principles of control of the classes of weeds;

Economic value of certain plants and of various plant products such as cellulose, alkaloids, glucosides, oils, latex, sugar, starch and proteins;

"Hardening" of plants;

"Short-day" and "long-day" plants;

Methods employed to induce chromosome changes.

The book has retained its logical development of subject matter. As in former editions, the illustrations are noted for their clarity. The method of presentation again offers a definite appeal to the student.

392 pages *273 illustrations* *6 by 9* *$2.75*

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SCIENCE NEWS

Science Service, Washington, D. C.

MOLDED PLASTIC AIRPLANES

FOUR aircraft companies and two research laboratories are aggressively attacking the problem of molding airplanes out of plastics for American defense, according to *Modern Plastics*. Army, Navy and civil aviation authorities, and the airplane industry in general, are watching these experiments to determine the place of synthetic resins in the future of aircraft.

So far the use of resins has been limited to experimental models of training and light commercial planes and the quantity production of minor airplane parts. In airplane structures, such as wings and fuselage, the resins are used very much as glues were in the days of the first World War, with wood veneers used as the reinforcing agent. The molded airplanes are really of plywood resin-bonded construction. Unlike the early glued plywood airplanes, the resin-bonded modern craft are said to be stable and unwarped under all atmospheric conditions, free from internal strains and proof against molds, fungi, water, oil and gasoline.

A five-place Fairchild Model 46, with molded fuselage and wood wings with resin-bonded plywood covering, was first flown three years ago and is today in active service. The Fairchild-owned Duramold Aircraft Corporation has a new molding process that uses a rubber bag as one half of the form. The other non-flexible half is made of sheet steel, cast metal or wood. The advantage of this method is that the flexible die assures equal pressure over all surfaces whether curved or not, which is not possible with conventional hydraulic or mechanical presses. Fairchild PT 19 training ships now in quantity production use plastic plywood spars which are said to be less costly and stronger than solid spruce.

The Summit plane, now undergoing government tests, was molded by Aircraft Research Corporation of Bendix, N. J., and is believed to be the first completely molded airplane body in the world. Wings, fuselage, tail assembly and controls were molded as complete structures. It is claimed that whereas a commercial plane equipped with 75 h.p. motor will cruise at 95 miles per hour, the Summit plane similarly powered will cruise at 125 miles per hour because all surfaces are smoother. The Vidal process used employs thermosetting and thermoplastic types of resins for bonding plywood veneer. The same manufacturing methods are being used to make boats, skis, racquets and automobile parts. Its first plastic-plywood airplane, a primary trainer, was flown recently by the Timm Aircraft Co. of Van Nuys, Calif. In properly contoured forms, spruce veneers are superimposed one upon another, using a thermosetting phenolic resin applied on each layer during assembling.

A fellowship on plastic airplane construction has been established at the Mellon Institute, Pittsburgh, by the Glenn L. Martin Co., looking toward the mass production of airplanes from plastics instead of by the slower riveting and welding of metals. In the plastics section of the National Bureau of Standards there is a research group working on a National Advisory Committee for Aeronautics project to develop factual information on the physical properties of reinforced plastics. Eighteen synthetic resins for impregnating and bonding wood veneers have already been tested.

In dozens of minor ways plastics are entering into aircraft. Instruments have phenol-formaldehyde housings. Windows in transport and military planes are made of acrylic resin sheets. Propellers are made from wood laminated with plastic. Coatings are made of synthetic resins. —WATSON DAVIS.

THE SHORTAGE OF TIN IN GERMANY

GLASS is being widely used by German manufacturers as a substitute for tin cans; so extensively, in fact, that the glass container industry is unable to supply all the demand even though working at full capacity. This information has reached the Bureau of Foreign and Domestic Commerce of the Department of Commerce from the American Consulate General at Frankfort-on-Main.

Even prior to the outbreak of war, the bureau is advised, it was necessary to institute extensive measures of economy and substitution in the use of packaging materials, and during the war these measures have become greatly intensified. The shortage of packaging-material arises from the fact that, to a high degree, the nation is dependent upon foreign sources for the requisite raw materials—wood, wood pulp, tin plate, jute and other fibers, etc. The leading packaging materials obtainable from domestic sources are glass and plastics, and so great is the demand for substitute containers made of these materials that the producing companies are now taxed to the utmost capacity.

In addition to glass for tin plate, other substitutes are of paper for jute sacks, paper for wood, and impregnated cardboard for metal sheet. Old containers are being carefully salvaged and used again, but this is made difficult by the shortage of railroad rolling stock, and the restrictions on automobiles, so that transport charges for empty containers are high.

Another substitute for tin plate is sheet metal covered by a film of synthetic resin. Collapsible tubes are being made of plastics at the rate of a million monthly. Additional savings have been effected by dispensing altogether with packing for some materials, such as soap; by using cheaper rather than more expensive type of paper; and by prohibiting the use of cartons and outside containers for products already in paper wrappers.

DOUBLE SNEEZERS

THE way you sneeze, if you do it in some peculiar individual fashion, may be inherited, it appears from a report by Dr. Milton H. Erickson, director of psychiatric research and training at Eloise, Mich., State Hospital, in the current issue of the *Journal of Genetic Psychology*.

Dr. Erickson reports finding double sneezers in three generations of the same family: mother, daughter and granddaughter.

A double sneezer is a person who always expects and usually experiences a second sneeze in rapid succession to the first, usually within one to two seconds, rarely longer. With the hay fever season in full swing, you may be able to observe some double sneezers yourself.

In the group Dr. Erickson reports, the double sneeze pattern was first observed in the young woman of the middle generation. Her relatives and friends thought it was an acquired mannerism, possibly the result of having as a child copied someone or done it as a trick until it became an ingrained habit that persisted after the trick or the imitation was forgotten.

The young woman herself, however, "regarded it as an innate, rather than as an acquired pattern of behavior over which she had no control, constituting nothing more than an amusing physiological peculiarity. She offered the explanation that it might be similar in character to the frequently encountered sneeze reflex to bright light or temperature changes."

When, however, this young woman's three-weeks-old baby started double sneezing, even making faces after the first sneeze as if expecting another, just as the mother did, Dr. Erickson began to wonder whether the pattern was not inherited. It was not possible for the tiny baby to be imitating her mother, much less double sneeze as a trick.

The baby's mother had thought she was the only one in her family who double sneezed, but after her baby started doing it, she discovered that her own mother, the baby's grandmother, had the identical double sneezing pattern.

This might all be coincidence, rather than inheritance, Dr. Erickson says. In favor of the inheritance idea he refers to the report of two New York scientists, Dr. C. Landis and Dr. W. Hunt, that "complicated bodily responses exist and are exhibited in a pattern-like fashion" —among the responses being sneezing and coughing—and that the general pattern of these responses tends to remain constant regardless of age, sex and race.

"To this may be added," Dr. Landis concludes, "that variations in the pattern may be inherited."—JANE STAFFORD.

CHILD CRIPPLES OF THE UNITED STATES

NEARLY 250,000 crippled children—a pathetic army of victims of infantile paralysis, burns, rickets, and other crippling misfortunes—are now doing their bit toward helping themselves and other cripples by having their cases recorded on state registers, according to the latest figures issued by the U. S. Children's Bureau.

Over 99,000 crippled children were added to state registers last year, a rapid net gain of 77,000 toward the goal of recording facts about all crippled children of the country. The number of such children is believed to be about half a million. Among the young cripples removed from the registers last year as having reached 21 years, or for other reasons, were 7,000 reported cured.

While the state registers were established originally by state agencies helping crippled children under the Social Security Act, the recording of all crippled children, not merely those given state aid, is urged. Medical diagnoses and other facts thus recorded are regarded by the bureau as highly valuable in attacking this large problem.

Most numerous among child cripples are found to be infantile paralysis victims, analysis of 188,579 cases on the registers shows. Over 36,000, or 19 per cent., owed crippling to infantile paralysis; 19,000 had spastic paralysis; 14,000, clubfoot; 11,000, the bone infection known as osteomyelitis; others suffered from burns, tuberculosis of bones or joints, harelip or cleft palate, rickets, and other troubles.

SCIENTIFIC RESEARCH AT THE NEW JERSEY EXPERIMENT STATION

RESULTS of scientific research, ranging all the way from chemicals for driving off mosquitoes to calves whose mothers never saw their fathers, were shown at Rutgers University on August 19 to a group of visiting editors, publishers and radio broadcasters. The demonstration was under the direction of Dr. W. H. Martin, dean and director of the College of Agriculture and the Agricultural Experiment Station.

Because of the proximity of areas of light, fertile soil to great urban centers of consumption, New Jersey has long been famous as a truck-raising state. Prominent in the exhibits were some of the newest products of the vegetable breeder's art, notably hybrid corn and pedigreed tomatoes.

New Jersey was also the first state in which long-distance breeding in cattle was put into practice by cooperatives organized for this purpose. In this type of breeding, one high-grade bull can sire calves over a radius of many miles without ever leaving his own pen or having any of the cows brought to him. An extreme case of distance in artificial insemination occurred when a bull in Idaho became the father of a calf in New Jersey, through the agency of air express.

Mosquitoes have lost some of their terror in what used to be thought of as the number one mosquito state, since investigators worked out a new and more effective spray. The new mosquito repellent has even been used by expeditions in the African bush, to keep away the dreaded tsetse flies.

Chemical warfare against another class of enemies, in the soil rather than the air, is exemplified by new types of soil disinfectants that kill off harmful fungi and bacteria. Vegetables, flowers and field crops grown in soil thus cleared of invisible enemies bring in good yields, while similar plantings in unprotected soil frequently turn out total failures.

THE HUMMING-BIRD

THE humming-bird is easily the quickest thing in feathers, and probably the most skillful of all flying creatures, is stated by Dr. Winsor M. Tyler in a new publication of the Smithsonian Institution.

The bird's wings are tiny, but powerful for their size. They beat at a rate as high as 75 times a second; when the bird is "standing still" in the air the rate is 55 beats a second. Seven hundredths of a second is all the time a humming-bird needs to get off a perch. Straight-ahead flight reaches a speed close to 50 miles an hour.

Humming-bird nests are tiny but beautifully constructed, lined with soft plant down and covered with bits of lichen.

Usually the female does all the building. The young are no bigger than peas, naked, probably blind and helpless when hatched. They grow very rapidly, however, and in two weeks are as big as their parents and ready to leave the nest. Then the family breaks up and the parents separate and go back to single life.

Humming-birds make long migration flights, timing their travels to correspond with the blossoming of the flowers that supply their food. They not only sip nectar but eat large quantities of insects. Their appetite for sweets is phenomenal. They have been known to eat two teaspoonfuls of sugar daily—about a third of their own weight in sugar.

For all their daintiness, grace and beauty, humming-birds have tough dispositions. They bicker with each other in rasping little, mouselike voices. And they viciously attack birds many times their size, darting and diving at them, depending on speed and agility to gain immunity from any counter-attack by the victim.

FOSSIL INSECTS IN RUSSIAN DEPOSITS

FOSSIL remains of insects that lived thirteen million years ago in what is now the northern Caucasus region of the USSR have been found in large numbers by an expedition of the Russian Academy of Sciences. About 3,500 specimens have already been removed, according to *Tass*, the official Soviet telegraphic agency.

The finds were made near the town of Voroshilovsk. The region is arid and highly saline now, but in Miocene times there must have been abundant fresh-water pools, for the insect fossils are those one would expect to find on the shores of summer ponds; flies, dragonflies, and a great many mosquitoes.

The soft, silty mud, which hardened into stone ages ago, must have been in exactly the right condition then to hold the insects it caught and to preserve the imprint of their bodies perfectly. Notable among the specimens collected are sixty butterflies, in which not only the wing-nerves are in perfect condition, but the outlines of the scales with which the wings were covered.

Perfection of this degree, in fossil insects, has hitherto been found only in the rock strata of Florissant, Colo., and the region around Spokane, in this country, and in some of the great lignite pits near Halle, Germany.

ITEMS

A NEW wilderness area of 370,000 acres has been set aside in the Maritime Province on the Pacific shores of Asiatic Russia. Its primary objective is to preserve intact forest growths of a number of notable tree and other plant species that were more wide spread before the great Ice Age of a million years ago, but which have become extinct elsewhere in the world. Animals of equally ancient lineage roam the woods, including spotted reindeer, Ussurian tiger, Himalayan and Ussurian bear and Manchurian hare.

OREGON STATE, 100; Big Blaze, 0. Scores like that will be tried for by teams of college men at Corvallis, Oregon State College, under the direction of the U. S. Forest Service. The game is more strenuous than even big-time football, and it is played "for keeps"—it is fighting forest fires. The teams are to consist of twenty-five men each, all picked for size, strength and endurance and trained for skill and teamwork in combating forest fire. Stationed at CCC camps in the timber country, they will "sleep with their boots on," ready to go into action day or night, at the first drop of a spark. Between fires, the men will work on regular forestry projects, at $30 a month. While fighting fires they will receive in addition regular forest fire wages.

FARM population in this country is still increasing, according to estimates of the U. S. Department of Agriculture. As of January 1, 1940, the American farm population was placed at 32,245,000, which is an increase of 186,000 over 1939. The increase, however, has occurred mainly in areas not well adapted to commercial farming. In the richer, commercial-farming regions there was enough migration away from the farm during the past ten years to have brought about a reduction in farm population.

CORN roots push themselves deep and far through the soil, yet the ones that are nearest the parent plant are most efficient in absorbing water. This has been demonstrated in the experiments of Dr. Charles H. Davis, of the University of Arizona. Dr. Davis grew young corn plants in boxes of soil which permitted the development of a four-foot spread of roots. Each box was provided with one glass side, so that the roots could be accurately counted and measured. Measurements of soil moisture, taken every four inches along the length of the boxes, showed that roots nearest the plants absorbed water faster than did longer roots pushing out to greater distances. Not only that, but the shorter roots were able to extract water from soil dried to a point at which the plants theoretically should have wilted, and at which they actually did wilt when the roots farther out had to attempt the task of extracting water a little later on. Dr. Davis's experiments are reported in detail in the *Botanical Gazette*.

THE longest-tailed bird for its size ever found is a new bird-of-paradise species newly added to the collections of the Australian Museum at Sydney. The bird, which trails a three-foot tail after a nine-inch body, was collected in New Guinea by J. L. Taylor and J. R. Black, leaders of the recent Hagen-Sepik patrol. The long tail, which grows only on the male bird, consists mainly of two ribbon-like white plumes. The body and wings are brown, with metallic green throat and head. At the upper base of the bill there is a large tuft of velvety feathers shot with green, while a fiery copper band runs across the chest. The female is reported to be a plain brown bird. Like all its tribe, this new bird-of-paradise concentrates its beauty in its feathers. Its voice is described as a clicking or hammering noise, like a riveter at work. It has been given the name McNicholl's ribbon-tailed bird-of-paradise, after Sir Walter McNicholl, Administrator of New Guinea.

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SCIENCE NEWS

Science Service, Washington, D. C.

AN INFRA-RED PLANE DETECTOR

THE reported British sensitive detector for airplanes, which makes use of invisible rays from the plane's engine, probably employs the infra-red radiation given off from any hot object and makes it visible by a method similar to that employed in the electron microscope recently developed to permit ultra high magnification. A similar American device is said to have been tried at the recent maneuvers of the First Army, but no details have yet been made public.

At the December, 1935, meeting in St. Louis of the American Association for the Advancement of Science, Dr. Vladimir K. Zworykin, of the Radio Corporation of America, showed an infra-red telescope that caused excited comment. In a Science Service dispatch at the time, Watson Davis, director of the service, described it as follows:

"The new device, which looks like a telescope from the outside, does its seeing by the infra-red rays that the unaided eye cannot see.

"The heart of the new infra-red 'eye' is a thin film of caesiated oxidized silver, deposited on a metal plate. This substance is especially sensitive to infra-red light, from the limit of visibility, at about 8,000 Angstrom units, to about 10,000 units.

"When the infra-red image of some object, either giving off infra-red rays itself or reflecting them from an infra-red searchlight, is focused on this special film, it gives off a stream of electrons from all the lighted parts of the image. These shoot up a tube, passing through a series of electrically charged rings. This bends them as a lens bends light. This part of the apparatus it called an 'electron lens.'

"The focused stream of electrons, now arranged in image form again though invisible, strikes a second screen, this one covered with a fluorescent substance, working on the same principle as the ordinary fluoroscopes used in hospital x-ray rooms. This turns the invisible electron image into a visible light image, very clear and distinct. The process is thus summed up in three steps: first, the infra-red rays from the object itself; then, the translation into electrons; finally, the second translation of electrons into an image shown in visible light."

At that time, possible wartime uses were predicted. The infra-red rays are given off at night as well as during the day. They pass freely through haze and smoke, but any fog, except a very thin one, stops them. However, such a fog would hamper the movements of the airplane in any case. Funnels of warships, like airplane engines, also emit infra-red rays, as do clouds of hot gases from engine exhausts. The device can be used for invisible signaling with an infra-red searchlight as transmitter and an infra-red telescope as receiver. An observer not provided with such a telescope, even in the path, would be unaware of the rays going past him.

The electron microscope, demonstrated by Dr. Zworykin last April to members of the American Philosophical Society, employs the electron lens. Magnification of ordinary microscopes is limited because they will show no details smaller than the waves of light with which they are viewed. But the electrons are still smaller, and by focusing these, extreme magnifications up to 20,000 times or more, have been secured.

SYNTHETIC SAPPHIRES

THE war in Europe threatens to cause a shortage of synthetic sapphires used as the jewels in fine American watches. These tiny bits of very hard material are essential as the bearing surfaces of pivots and other parts of watches, chronometers, and such scientific apparatus as balances and meters.

The supply from Switzerland, Germany and France, where they are made, has been cut off by the war. There is no American industry established because of the low cost at which the European manufacturers were able to furnish satisfactory watch jewels, the price being about a cent and a half each.

Costume jewelry, largely made of synthetic gems and even cheaper glass imitations, is also being curtailed by the war.

It is known that at least one leading watch manufacturer has appealed to government agencies for help in meeting the shortage. An attempt may be made to establish an American industry to meet the need.

Since 1902 synthetic rubies and sapphires have been manufactured by the Verneuil process, which fuses alumina (Al_2O_3) in an oxyhydrogen blowpipe to produce a substance that chemically is the same as the naturally occurring rubies and sapphires.

Synthetic gems are chemically and physically identical with the natural stones, except for minor internal structure that does not affect their usefulness. Rubies or sapphires, either natural or manufactured, differ only in their coloring; red stones are called rubies and all others are sapphires. The red of rubies is caused by chromium oxide in small amount; the blue of sapphires is due to iron or titanium. Synthetic white sapphire is the same as natural colorless corundum.

In the process of manufacture extremely pure, finely powdered alumina must be used. The fusing process results in a pear or carrot-shaped mass of alumina of from 300 to 400 carats. This boule, as it is called, is split into halves and then sawed into watch jewels and instrument bearings. The hardness of rubies and sapphires is 9 on the usual scale of hardness, ranking next to diamonds with a 10 rating.

The most important centers for the manufacture of the various types of synthetic rubies, sapphires and other gems are Locarno and Monthey, Switzerland; Annecy and Jarrie, France; and Bitterfeld and Zwickau, Germany. These plants are stated to have a daily capacity of 750,000 to 1,000,000 carats. Three-quarters of the output finds industrial use.—WATSON DAVIS.

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NEW PATENTS

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PART of the support system of the new 200-inch telescope, being completed at the observatory of the California Institute of Technology on Mt. Palomar, is covered by a patent just granted to Reinout P. Kroon, of the Westinghouse Electric and Manufacturing Company at Lester, Pa. The patent, number 2,212,346 and one of 741 granted this week, is assigned to the Westinghouse Company.

Mr. Kroon was one of the engineers in charge of the work on the telescope mounting, which was built at the Lester plant. With the telescope so large and heavy a certain amount of distortion of the great yoke structure which holds the tube is unavoidable. However, this must not be transmitted to the tube itself, for it would spoil the alignment of the mirrors and other optical parts, thus ruining the star images. Mr. Kroon solved the problem by hanging the bearings, in which the tube moves, on a system of radial rods, somewhat like the wire spokes of a bicycle wheel. These keep the bearings centered at the right place, yet permit a certain amount of freedom in the supporting yoke.

In his patent specifications, Mr. Kroon states that, while his invention "has been described with particular reference to a telescope, it is to be understood that it may be used in any situation where similar conditions and requirements are encountered."

Dr. August H. Pfund, professor of physics at the Johns Hopkins University, was granted patent 2,212,211 for a method of detecting and measuring certain gases when mixed with other gases. He claims that the apparatus can detect 1/1000 of one per cent. of carbon dioxide in air. One possible use is in the detection of minute quantities of the poison gases used in war.

The method is applicable to gases consisting of more than one kind of atom. Thus, carbon dioxide consists of carbon and oxygen, hydrogen sulphide of hydrogen and sulphur, nitrous oxide of nitrogen and oxygen. It will not detect gases like oxygen, hydrogen or nitrogen, which consist of atoms of the same kind.

When infra-red waves, like light, but too long to affect the eye, pass through these gases of several kinds of atoms, certain wave-lengths are absorbed and converted into heat. Conversely, if the gas is heated, these same wave-lengths are emitted.

In one version of the apparatus, a jet of the gas to be detected is heated by an electric coil. It becomes a miniature broadcasting station, sending off waves of its proper length. These are reflected back and forth in a metal cylinder, then out the other end to a thermopile, which converts the infra-red waves to electricity and indicates their presence on an electric meter.

In use, the cylinder is first filled with air known to be free from the gas, and the current measured. Then the mixture being investigated is admitted instead. If this contains the suspected gas, a large part of the waves is absorbed, and the current is reduced. Even if other gases are present, they do not affect the results, because they are not tuned in to the proper wave length and cause no absorption. In another method of using the principle, Dr. Pfund measures the heating produced in the gas when it absorbs the particular wave length.—JAMES STOKLEY.

OVERCROWDING IN THE NETHERLANDS INDIES

MILLIONS of natives of Netherlands Indies are heading toward a serious internal situation, the result of overcrowding. So dense is the population of Java that the world's only agricultural areas rivaling this island's crowding are the Nile Valley, parts of the Ganges Valley, and some regions in China, according to a report in the Population Index issued by the School of Public Affairs of Princeton University and the Population Association of America. A 1930 census showed 817 persons per square mile, with 1,274 in the densest area. At the present rate of growth, by the year 2,000 Java, including its close-linked neighbor island, Madura, will be thronged with 116,000,000 people which the population experts flatly call "an impossible figure." Actually before that time, population increases will probably force down the living level, so that from bad living conditions rates of disease and death will rise. To forestall this misery, Dutch officials developed agriculture and industry until limits were virtually reached by 1930.

Inducing Javanese natives to colonize the less densely inhabited Outer Provinces of the Indies is the only other way out which officials have evolved. This colonization has the added merit, for the Dutch, of filling empty space, thus removing temptation from land-hungry Japan.

The seriousness of the situation is increased, the report points out, by the vulnerability of Netherlands Indies economy to changes in world trade. The richly endowed islands produce important quantities of rubber, tin, sugar, coffee, tea, cinchona for quinine, and other agricultural and mineral trade goods. But if trade demand falls, as it did during depression times, the islands are severely stricken.

"One hesitates to contemplate the situation," says the report, "if the extension of hostilities in the Far East should cut Java from Western markets, on which the actual lives of the natives depend."

THE HEALTH SITUATION IN EUROPE

EUROPE'S chances for escaping war-borne diseases this winter are not too bright. Like the prospects of famine, a hazardous health situation hangs on some vital "ifs." If this winter proves severe, as last winter was, fuel shortage will join forces with weather to promote disease. Supplies of fuel for household heat are expected to be even shorter than last winter. A mild winter would minimize misery from this cause, but cold waves would render people already weakened by malnutrition and other war experiences a ready prey to disease.

If health and sanitation services disrupted by war are not resumed, with sufficient medical supplies, there will be weak spots in health defense where trouble may spread. The speed with which French refugees are returned to their homes is important for health. Pneumonia and other respiratory diseases are rated as the chief risk which Europe's population faces, as conditions are now. Tuber-

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culosis is likely to take heavy toll, if the work of careful organization is undone, and masses of people are permitted to spread the disease through overcrowding, and other poor living conditions.

If Europe is acutely short of food supplies, as some observers claim, or if Nazi Germany will not share and apportion supplies equably, a train of well-known malnutrition evils is in store.

Another "if" in the food situation concerns transportation. Food *en route* from one area to another may be delayed or cut off by transportation breakdowns, all too frequent. If this occurs widely, due to fuel shortage or slowness to resume and repair transportation services, even food available will not be used to best advantage to nourish hungry people.

So far as epidemics go, this war has thus far—fortunately—failed to make sensational history. Typhus has been endemic in Poland and the Balkans. There is always some typhus in eastern Europe. The experiment in which several thousand doses of two new American-developed vaccines were given in Hungary and Rumania, to test their effectiveness as protection against the fever, has been hampered by political changes in Rumania. Since the area of Rumania where the tests were made has since become subject to Soviet Russia, the physicians in charge have presumably withdrawn. But in several months, a report of the effectiveness of the vaccines is expected to come from the Hungarian group.—EMILY C. DAVIS.

SCIENTIFIC MEN AND POLITICIANS

THE scientist is more honest in his work than is the politician because lack of morality in science is likely to destroy the experimenter, declared Dr. Harlow Shapley, director of the Harvard College Observatory. It is perversion of international morality, be believes, not of gadgetry, that has resulted in the epochal decay of present-day society. Dr. Shapley's statement was issued to explain the purpose of a Conference on Science, Philosophy and Religion to be held in New York on September 9.

"Morality in physics and chemistry is to some extent forced," he said. "The scientist, naturally, is as human in his irrationality as others. Survival, however, requires a kind of honesty. The unmoral experimenter poisons himself or blows himself up. If only a false economic doctrine, while still prenatal, would also electrocute its progenitor! Or an education schism backfire during fabrication and reduce its advocate to impotent illiteracy and confusion!"

A closer communion between the physical, psychological and social sciences was urged by Dr. Shapley as a means toward development for the social and psychological sciences of "a logical and rigorously experimental method similar to that which has brought such achievement in the physical sciences."

"The value of these methods," he said, "are well-publicized by the success of every-day tools. You rely on your electrical refrigerator, designed by the engineers; but you trust mighty little your politicians and diplomats. Thousands of people ride in automobiles with complete confidence in their mechanism. They worry not at all about the engine, reserving their anxiety for the unverified assertions of their congressman, for the economic system, for the treachery of man in fields where a forced morality does not exist. If we are to escape descent into darkness the scientist must join forces with other intellectual leaders, because on the advances in the educational, social and political fields does the advance of our science depend. The September Conference on Science, Philosophy and Religion is an effort in just this direction. Those of us who projected the conference hope that from it will come a better understanding between the different fields of learning that we represent, as well as a dynamic restatement of the rights of man and the democratic way of life."

ITEMS

DUTCH HARBOR, Alaska, felt the tremors of a strong earthquake shock on August 21, about 180 miles to the south, on the ocean bottom, the U. S. Coast and Geodetic Survey has informed Science Service. The survey's steamer *Explorer* was in Dutch Harbor when the quake occurred, and her captain, J. H. Peters, reported that as felt on shore the disturbance was of force four on the international earthquake scale: it rattled doors and dishes, but caused no destruction. Reports were received by wire and radio by Science Service from the following observatories: Georgetown University, Fordham University, St. Louis University, Pennsylvania State College, the University of Pittsburgh, the University of California, the Dominion Observatory at Ottawa, and the U. S. Coast and Geodetic Survey stations at Tucson, Ariz., and Ukiah, Calif.

RAGWEED pollen is scarce in the upper air over the ocean, but there are plenty of mold spores, which also cause hay fever, Oren C. Durham, chief botanist of the Abbott Laboratories in North Chicago, Ill., reported when the Bermuda Clipper landed in New York on August 22. Mr. Durham made the round trip on the clipper, exposing sticky glass slides to catch pollen grains, fungus spores, and whatever other particles might be adrift in the air. He examined them at once under a microscope on the clipper's cabin table. As the Clipper climbed over Long Island, he caught plenty of ragweed pollen grains, but after that there was no pollen, only mold spores. As the plane glided down to landing in Bermuda, and climbed for the clouds again, there were only traces of the spores, but at the 8,000-foot level of most of the return flight there were spores in abundance. No pollen was encountered until within 80 miles of the mainland, at 4,000 feet altitude. From there on in the slides were well spotted. Mr. Durham will next go to Yellowstone National Park by plane, to make studies of the pollens of that region (chiefly sagebrush) both at ground level and in the air. Following this, he will make a plane trip down the Mississippi, touching at St. Louis, Memphis and New Orleans. His final study for the season will be conducted at the Sun Valley resort in Idaho.

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SCIENCE NEWS

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MOSQUITOES IN THE TENNESSEE VALLEY

EIGHT new lakes, formed by the eight great dams of the Tennessee Valley system, have become health and pleasure resorts as well as sources of wealth and power for the nation because the malaria-carrying mosquitoes are not permitted to breed in the shallow waters along their shores. Workers in shallow-draft boats, in low-flying airplanes, trudging along on foot, patrol every spot where the malevolent insects might lay their eggs and prevent their coming with clouds of poison dust.

When the new lakes are all filled to normal height they lap shorelines amounting to some 5,000 miles, or twenty-five times the shoreline length of the Panama Canal. Not a mile can be neglected, either, for the lakes lie in seven states that have in past times been known as the heart of the malaria belt.

Control of mosquitoes (and hence of malaria) in the valley is the fruit of painstaking preliminary research, participated in by the U. S. Public Health Service, the Bureau of Entomology and Plant Quarantine of the Department of Agriculture, and the Rockefeller Foundation. Several steps in control were found necessary and all have been most thoroughly carried out.

First came a complete clearing away of all bushes and other growths along the zone over which the water level fluctuates, as the dams are first closed for filling, then opened to maintain navigation heights in the streams and to develop power. Malaria mosquitoes love to lurk and breed in such sheltered places, and that part of the shoreline had to be shaved clean. It cost money at first, but saved heavily on poison dust expenditures later.

A second element in the new technique was a radical departure in the schedule of pool level fluctuation. The purposes of flood control, power and navigation would not always permit fluctuation of the pools at the times when the variation was most needed for mosquito control. Early in the construction program the Health and Safety Department succeeded in obtaining the addition of one foot (called the "malaria control surcharge") to the heights of the dams.

Starting at the beginning of the mosquito-breeding season, the pool level is varied once every week or ten days —first to the maximum and then down to the minimum, each succeeding time falling slightly short of the preceding maximum. In this way the pool level is kept always a little ahead of the encroaching vegetation.

Finally comes dusting of mosquito-breeding waters with Paris green, diluted with soapstone, so that only half a pound of the poisonous green powder is spread per acre of water treated. Airplanes are much used: in 1939, pilots flew more than 300 hours to spread more than 100 tons of dust over 82,000 acres of lake shore. Boats with oil sprays are also in use, and men on foot to get at the less accessible places. Lately, copper arsenite has been found quite as effective as Paris green and only about half as expensive.

Public health officers keep close track of the incidence of malaria in the valley. Every year they make approximately 20,000 blood examinations, from samplings of the population. In the area as a whole the number of malaria cases has already been reduced.—FRANK THONE.

FOOD HABITS OF EUROPEANS

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HUNGER for some of Europe's millions will be lessened in days ahead, provided they can do a difficult thing—change their food habits. So it appears from latest reports from the European war food front, studied by agricultural economists in the United States.

The continent's short crops of rye and wheat, for example, can be balanced against a good corn crop in southern Europe and against a good potato crop, and somewhat reassuring totals on "food" can be obtained. But can peasants in countries unaccustomed to corn make good use of it? There's a catch in the arithmetic. Yet, from German sources has come the grim warning that conquered areas must exert themselves to the utmost to feed themselves.

"By tightening their belts and making some changes in their food consumption habits, they should be able in most sections to get through the winter," is the way the situation looks to the U. S. Bureau of Agricultural Economics. It foresees likelihood, however, of a serious situation in some regions, and among some consumer groups, because of difficulties in adjusting the food available to the requirements of the people.

Americans will recall that teaching hungry French and Belgians to eat American corn-meal, instead of wheat flour, during World War days proved so Herculean a task that the United States settled down to using the corn and sending more wheat to Europe. Nutritionists explain that this was not sheer contrariness on the part of hungry peasants. The French are more used to buying bread than baking it. Their farmhouse ovens are very different from quick American stoves. Corn-meal was thus a double problem—unfamiliar to taste and a major problem to handle. As for rice, some Belgians found it too strange for eating. Paradoxically, in rice-eating areas in India efforts to break rice famines with other foods have met with difficulty. It had to be rice. In our own country, the southern share-cropper clings to a pellagra-causing diet of monotonous cornbread, fat-back and molasses. It is a major victory when nutritionists can win over these, or other Americans, to unfamiliar foods needed to round out a diet.

Europe's worst food debits are in the rye and wheat crops, as the situation appears now. The fruit crop is also figured as smaller than last year's large crop. Supplies of fats and oils are probably 25 per cent. less than normal. The continent depends on outside sources for about half of the fats and oils it uses, and what its hoarded reserves now amount to is not known. On the credit side of the food ledger, however, are the large corn

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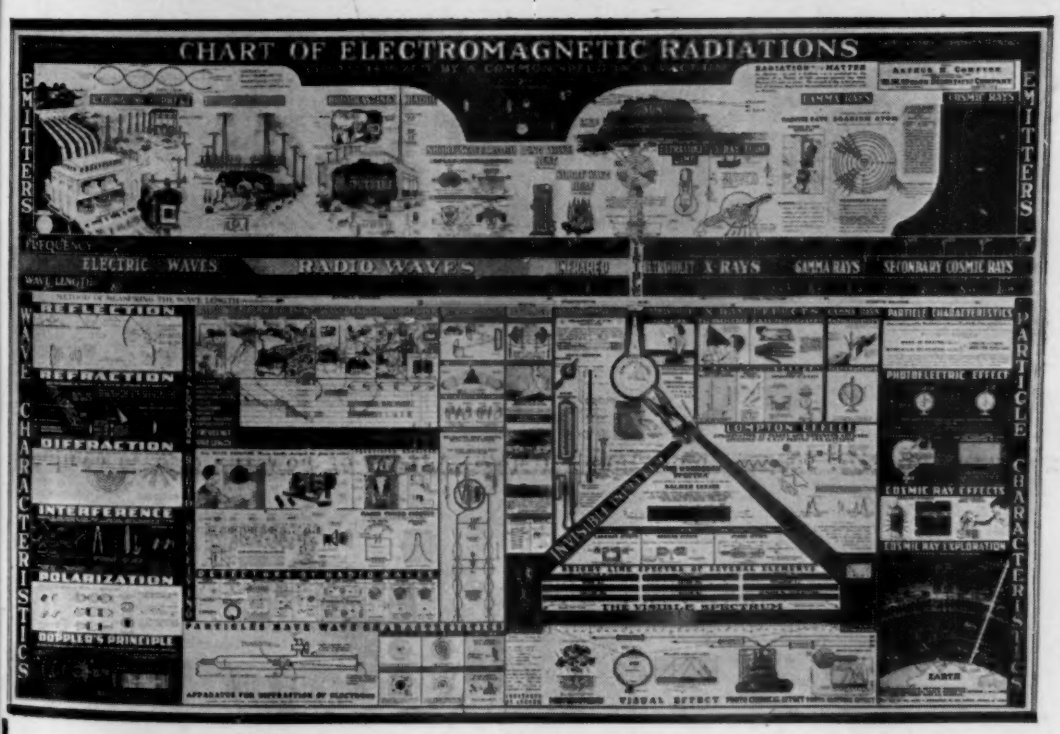

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and potato crops; a large vegetable crop; adequate supplies of sugar, doled out by rationing; considerable supplies of meat for the present, due to slaughter of more animals than usual. Balancing conditions on the egg situation, it is thought that, while many of northwest Europe's hens will be killed and commercial egg production reduced, the loss of the British market for eggs "may leave almost normal supplies of eggs available for continental consumption."

Disposal of these uneven supplies is another problem, hinging on transportation uncertainties and other fortunes of war. Eating whatever comes their way is the prospect for Europeans caught in these war tangles, and faced with what the most conservative observers term an "uncomfortable" winter.—EMILY C. DAVIS.

FARMERS OF FUTURE MAY NOT NEED FENCES; PSYCHOLOGISTS CAN "CONDITION" COWS TO STAY INSIDE A STRING ENCLOSURE, IT IS PREDICTED

(*Copyright, 1940, by Science Service*)

A SINGLE string hung between slender posts may be enough to keep the cow of the future in her pasture if cows are psychologically conditioned was suggested by Dr. Arthur I. Gates, of Teachers College, Columbia University, at the meeting of the American Association of Applied Psychology at State College, Pa.

The conditioning would only mean the use of a mild electric shock every time a cow approached the string. Even a cow soon learns to stay away from all strings after that.

Psychology could thus save the farmer the enormous costs of iron fences and electric devices now used. He stated that: "Although a farmer neighbor of mine declared that this was a daffy idea, it is good psychology." Aid to the farmer was but one of a wide variety of new jobs proposed for psychologists by Dr. Gates. They had been suggested to him, he said, in a poll of his colleagues.

Prevention of "flops" on the stage and among would-be literary best sellers is another job awaiting the shrewd psychologist, according to Dr. Gates. Publishers, he said, are already beginning to provide places for persons trained in this field. Children's magazines are employing psychologists in increasing numbers. Large stores will have their own psychologists in the future, he predicted. They will not only aid in selecting and training of clerks, but improve relationships between salesmen and customers.

Dr. Gates quoted Dr. H. A. Toops, of the Ohio State University as making another suggestion (it was Dr. Toops who proposed to him "conditioning" the cows). He pointed out that personality experts who will sell a whole ensemble, determined experimentally, to match the buyer's personality or purpose are needed. In his opinion psychologists will also find great opportunities in hospitals quite apart from the treatment of mental disorder. The use of the radio, music, conversation, rest, quiet games and various activities to aid the patient demands psychological insight. He believes that we need more of the spirit of adventure in educational psychology. There never has been and probably never will be enough first-class educational psychologists to do the work which able persons, trained in this field, are best qualified to do.—MARJORIE VAN DE WATER.

FREQUENCY BANDS FOR DIATHERMY APPARATUS

DIATHERMY apparatus used by physicians to give heat treatments by means of short-wave radio emanations will have their own frequency bands to prevent interference with other radio services, if plans outlined by E. K. Jett, chief engineer of the Federal Communications Commission, to the American Congress of Physical Therapy meeting at Cleveland are carried out.

Transmissions from electro-medical apparatus have actually been received across the continent and even across oceans, Mr. Jett reported in explaining the interference difficulties caused by diathermy machines. When diathermy interference first began to be serious a number of years ago, the disturbances were first attributed to stations operated by persons under the jurisdiction of foreign governments. The signals were traced to diathermy machines operated in medical centers and offices of private physicians. One machine was hitched to a telegraph key and signals tapped out in International Morse Code were easily read in Washington, D. C., and Great Lakes, Ill. From 10 per cent. to 82 per cent. of the channels in use for long-distance communication were interfered with at times.

Diathermy apparatus affects radio reception because the machines are essentially radio transmitters, Mr. Jett explained. The radiation that causes interference is not essential for therapeutic purposes and steps are being taken to prevent such radiation. Mr. Jett emphasized that the Federal Communications Commission recognizes the importance of electro-medical apparatus to the medical profession and he assured those present that the government will cooperate fully so that both services may continue without mutual annoyance.

At Inter-American Radio Conferences it was agreed that the various American nations should consider limiting diathermy apparatus to two frequencies in harmonic relation above 12 megacycles which will not interfere with existing radio assignments. A conference to bring together all the interested parties will be called in the near future.

INFANTILE PARALYSIS

WHEN dread infantile paralysis invades a human body, success or failure of the virus blitzkrieg hangs on all-important "ifs." A view of how the disease conquers, gained by anatomical study, was reported at Cleveland, to the American Congress of Physical Therapy, by Dr. John A. Toomey, of Cleveland City Hospital.

To produce the disease, the virus must contact gray fibered nerves which have naked axis cylinders, into which the virus can be absorbed and thus find transportation to its goal—the central nervous system. Gray fibers which the virus can reach for entry would include nerves in the nasal passages and about tastebuds of the tongue and networks of nerves in the stomach tract. The disease will strike with more force if the absorption of the virus is

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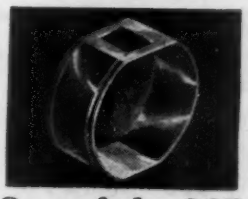

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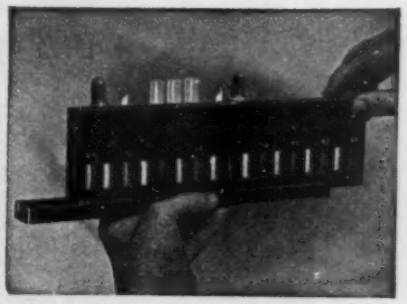

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rapid, if transmission through the body is quick and easy, if the strain of the virus is virulent, if the nerves are not in healthy condition, or if other factors favor the invading virus. If the distance between the virus' point of attack and the central nervous system is too great, the virus may fail, because it may be absorbed, excreted, or destroyed long before reaching the spinal cord.

Dr. Toomey, who has long held that infantile paralysis virus enters the body *via* the gateway of the gastrointestinal tract—that is, by being swallowed—declared that some years ago few research workers could be found to agree with him. "To-day the situation is changed," he said, "and nearly every one working in this field is willing to admit that the gastrointestinal tract may be at least one of the portals of entry."

THE PROBLEM OF THE INTERNE

WHILE serving a year as an interne in a hospital is an important part of American medical training, only 17 per cent. of the medical schools of the country now require it before the M.D. degree is awarded, according to figures issued by the American Medical Association.

Editorially the *Journal* of the American Medical Association takes the stand that "medical schools should not make the interneship a part of their requirement for a degree." The difficulty is that the tendency is to make the school or dean responsible for placing its graduates as internes, and having recommended a student for interneship in the fall of his final year, the faculty would scarcely refuse its approval in June.

A change of scene for medical students is recommended by Dr. William Dock, of San Francisco, in discussing the problem of internes. They should not interne in hospitals in which they took undergraduate training. Medical schools that control hospitals should not select, in his opinion, internes for those hospitals almost wholly from its own graduates, as is often the custom.

Dr. Dock considers that the problem of the fifth year of medical training might be left to state licensing boards, of which 44 per cent. now require the interne year before a student can practice as a physician.

Compilations of the American Medical Association show that there are 76 medical schools in the United States and Canada. In the past year 5,703 received the M.D. degree. Students enrolled numbered 24,194, not including internes. One out of twenty of the graduates were women.

ITEMS

SEX reversal in fish, changing females into males, has been accomplished by injecting synthetic male sex hormone, in experiments performed by Drs. F. M. Baldwin and H. S. Goldin, of the University of Southern California. The fish used were young female swordtails. The males of this species have a long point spine projecting backwards from the tail, which gives the fish its name. The female normally lacks this spine, but injection of the male hormone caused the ones under experiment to grow it, as well as to develop internal changes in the reproductive glands characteristic of the male.

DEADLY hydrocyanic acid, in concentrations sufficient to be dangerous to livestock, has been found in several species of plants by Drs. E. A. Moran, R. R. Briese and J. F. Couch, of the Bureau of Animal Industry of the U. S. Department of Agriculture, and has been reported to the Washington Academy of Sciences. The plants include the wild California almond, two western species of wild flax, a southwestern star thistle, the eastern manna grass and a widely distributed marsh plant known as arrow grass.

COPPERHEAD snakes are less deadly than rattlesnakes, water moccasins and coral snakes. The bite of the coral snake is very dangerous because the venom of this reptile attacks the nerve centers. The venom of rattlesnakes, moccasins and copperheads, on the other hand, destroys red blood cells and breaks down the walls of the blood vessels. Serious as this condition is, it takes a little longer period before it becomes fatal, giving a chance for the victim's recuperative powers and medical aid to overcome the effect of the snake venom. Copperheads are dangerous and there are records of deaths from the bite of this snake, but such deaths are not common. The reasons why the copperhead is less dangerous than the rattler are that the copperhead has shorter fangs, less virulent venom, and, because of its smaller size, injects a smaller amount of poison into a bite.

STIMULATION of diesel airplane engines with oxygen just at take-off may make possible wide-spread future use of much safer and more economical engines, according to Professor Paul H. Schweitzer, of the Pennsylvania State College. Feeding oxygen into the intake air of a diesel engine increases its power output by 55 per cent. for a few minutes without undue strain. Airplanes usually require about a third more power for take-off than for ordinary flight. Professor Schweitzer suggested that oxygen boosting for take-off might overcome the diesel's handicap of somewhat greater weight per horse power when compared with gasoline engines. Diesels with lower fuel consumption and less fire danger have been used in many German and some American planes. A 3,000 horse-power transport plane would need about 160 pounds of liquid oxygen, costing less than $50, to supply an additional 1,000 horse power for two minutes required for take-off.

PARADICHLORBENZENE, a chemical now widely used in combating insect pests, has been found effective in preventing downy mildew, one of the worst diseases of tobacco, in a cooperative research project conducted at Chatham, Va., by the Virginia Agricultural Experiment Station and Duke University. PDB, as the compound is called for short, is introduced as a vapor over the seedbeds, which are covered with cotton sheeting to keep the vapor down during the period of fumigation. The odorous gas penetrates into the leaf tissues and kills the deadly fungus threads that are attacking them. At the concentrations used, the chemical is harmless to the young tobacco plants. Associated in the research were J. A. Pinckard, Ruth McLean, F. R. Darkis, P. M. Gross and F. A. Wolf. Results are published in full in *Phytopathology*.

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SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS READ BEFORE THE DETROIT MEETING OF THE AMERICAN CHEMICAL SOCIETY

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NEW methods of analysis and new means of studying the function in the human body of sulfur, as essential for life as iron, phosphorus or iodine, will be possible with heavy sulfur, according to chemists attending the one hundredth meeting of the American Chemical Society at Detroit. The production of heavy sulfur was described for the first time by Drs. David W. Stewart and Karl Cohen, of Columbia University. The researches were conducted under the direction of Dr. Harold C. Urey, head of the department of chemistry, who discovered heavy hydrogen in 1934, for which he received the Nobel prize. Later he prepared heavy forms of oxygen and other elements. Most elements consist of a mixture of several isotopes. These are made of atoms of different weights, though having similar chemical properties. Ordinary sulfur contains four: 95 per cent. being of weight 32; 4 per cent. of weight 34, which is the isotope now isolated; 1 per cent. of weight 33 and one part in 6,000 of weight 36. Separation of the isotope, at a cost of $1,500 per ounce as compared with a cent an ounce for common sulfur, was achieved with Dr. Urey's "counter-current scrubbing method," previously used to separate isotopes of carbon and nitrogen. A gas, sulfur dioxide, was passed upwards and a liquid, sodium hydrogen sulfite, was allowed to flow downwards through 150 feet of bent glass tubing. Sulfur 34 is more soluble in the liquid than the other varieties. Therefore, at the end of the process the liquid in the bottom contained about a quarter of the heavy isotope. Researches are now being made by Dr. Vincent du Vigneaud, professor of biochemistry in the Cornell University School of Medicine, using heavy sulfur to determine the role of the element in bodily chemistry. Using the isotope, sulfur atoms can be tagged at the start of an experiment and identified at intermediate stages, and at the end of the reaction. This method promises also to be of use in tracing sulfur in complicated organic reactions which are not concerned with living organisms.

CHEMICAL changes that take place in the blood of animals suffering from pneumonia was the subject of a report by Dr. M. L. Crossley, of the American Cyanamid Company. He and his associates, Bruno Vassel, L. G. Christopher, R. H. Kienle and G. L. Christopher, discovered changes suggesting a breakdown of the protein of blood serum during the course of the disease. When the animals got well, the blood serum became normal again. The investigations of blood chemistry during pneumonia were undertaken in the hope of providing clues for better chemical treatment of this and other infectious or germ diseases. "How infecting agents cause disease," Dr. Crossley explained, "what changes occur, where these changes are initiated, the nature of the resulting products and their effect on the animal are questions which must be answered before chemotherapy can be highly effective in relieving man of the many ills that now reduce his efficiency, limit his usefulness and endanger his life. These are difficult problems to answer. Even if microörganisms worked as termites, boring into the tissues and reducing their strength, it would still be a difficult task to examine the nature of the damage done and relate it to the cause, and man can not be sawed up like a log nor subjected to physical and chemical tests in ordinary laboratory equipment. It is imperative to know the nature of the chemical reactions involved in infectious diseases, this knowledge is essential to the future development of chemotherapy."

DR. PER K. FROLICH, director of the chemical division of the Esso Laboratories, Elizabeth, N. J., gave the first technical report of the new "butyl rubber," developed after ten years of research by Standard Oil chemists. It is colorless, odorless, tasteless and more stretchable than rubber from trees. In his address, prepared in collaboration with R. M. Thomas, I. E. Lightbown, W. J. Sparks and E. V. Murphree, he said that Nature's rubber molecule and all its synthetic semblances are either wholly or predominantly polymers, or multiples, of much smaller molecules which belong to a class of highly unsaturated compounds called diolefins. It is to this diolefinic origin that the natural and synthetic rubbers owe their extreme degree of unsaturation and resultant chemical reactivity. Chemists working on rubber have been inclined to associate the elasticity and other important physical properties of rubber with its chemical unsaturation. Chemists in the Esso Laboratories, however, in their studies of chain-like polymers with no residual unsaturation, recognized a majority of these important rubber-like properties. Polymers with no residual unsaturation may be made by uniting the simple olefins, or compounds, which are readily available as constituents of petroleum refinery gases. But these olefins because of their saturated character resist all efforts to vulcanize them with sulfur. Through long years of research by a large group of men, the Esso Laboratories have now developed a method of co-polymerizing olefins with small amounts of diolefins to give just the proper degree of unsaturation for vulcanization—but no more. Out of these efforts has come butyl rubber which after vulcanization is a product with substantially no residual chemical unsaturation. As a result, butyl rubber is characterized by a remarkable stability and durability which for many purposes make it superior to natural rubber and to other synthetics. By variations in the composition of the raw materials employed, it is possible to obtain products that differ considerably in their detailed properties, but the basic characteristic remains the same insofar as the limited unsaturation is concerned. His researches have made it possible to pick out definite qualities in which the butyl rubber should excel. These can be achieved, thus adapting it to specific purposes, such as tires, electrical insulation, hose, etc., which may make different demands. Future manufactur-

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ing plans are dependent on the progress of tests now being made and will also be governed by the defense needs of the U. S. Government.

MANY parts of the present-day automobile would be impossible without some substitution for natural rubber, was stated by James C. Zeder, chief engineer of the Chrysler Corporation. He spoke before a symposium on rubber, synthetics and plastics in the automotive industry, held as a part of the one hundredth anniversary meeting of the society. "The most certain way of expanding the production capacities for synthetic rubbers is to develop uses for them in such places where cost penalties will not be a major objection, and where the man-made rubber may stand on its own as an engineering material. In only a few instances has synthetic rubber been substituted for natural rubber. Yet synthetic rubber has taken the place of natural materials that have qualities that are not easily varied to suit the engineer's needs, or qualities that vary so much in nature that it is desirable to use manufactured materials that will maintain a uniformity of characteristics day in and day out." Many improvements in automobiles await the development of a better material. Mr. Zeder pointed out that "The only thing preventing us from decreasing the brake drum from a 12-inch to perhaps an 8-inch diameter is the maximum pressure which the lining will endure. All the other parts of the brake mechanism can be subjected to greater pressures, and if a better synthetic material can be developed for the lining, this reduction will be made, and we shall have a smaller and a better brake. The same thing is true in the clutch. Here, too, a better clutch plate lining must be found, and when this is done, we shall have a smaller, better and less expensive clutch. Synthetic materials may solve the problem of a suitable fabric for automobile use. We now make cars of metal and rubber which will stand up for a number of years, but the fabrics used in the upholstery are perishable and can not be expected to last for the life of the car. The automobile industry needs an attractive looking, non-perishable fabric, possibly of synthetic origin."

WHEN science can produce gasoline entirely free from knock, double the power or mileage of present-day gas will be possible was stated by T. A. Boyd, of the General Motors Research Laboratories. "From an altogether knock-free fuel, it would not be hard to get either double the power or nearly twice the mileage per gallon, but not both at once. Such a fuel should make possible an engine of much smaller displacement. If with 100 octane number gasoline" (present-day fuels have an octane number of about 70), "miles per gallon could be increased only by 50 per cent., the saving to the car user would amount to half the present retail value of fuel. So even if the present cost of manufacture of gasoline, about five cents a gallon, had to be doubled to make the 100-octane fuel, there would still remain a net saving in cost to the car user of 20 per cent." Mr. Boyd stated that the shortage of gasoline which was feared in 1914 as the use of motor vehicles rapidly mounted has been kept off by chemical research. Then there was about an 18 per cent. yield of gasoline from the crude oil; now it is about 45 per cent., while 70 per cent. to 75 per cent. is possible in modern refineries. Because drivers up to now have been demanding better acceleration and hill-climbing ability, producers have been boosting the performance of gasoline, increasing it about 45 per cent. since 1927, but the improved economy, in terms of mileage, has been about 20 per cent. "Only incidental improvement in economy can be obtained when the primary objective is to boost power," he said. "It begins to appear that from now on the car users may prefer to take the benefits of further improvements in fuels and of advances in engineering in terms of more miles per gallon."

AUTOMOBILE owners were advised to place their cars in garages at night to preserve the finish by Ralph J. Wirshing, assistant head of the department of general chemistry of the General Motors Research Laboratories. This prevents dew from forming on the body, and dew seems to be an important factor in causing the failure of finish. It had formerly been supposed that ultraviolet rays in sunlight, the same ones that cause sunburn on human bodies, were mostly responsible for paint deterioration. However, carefully checked tests made over a period of sereral years in Florida, using a sunshine meter to gauge its intensity, showed that failure was greater with exposure from midnight to noon than from noon to midnight. This suggested that dew, followed by sunshine, was the offender, and confirmation was obtained when further tests were made with a "dew box" to produce it artificially. Rainfall was found not to have the same effect as dew.

AUTOMOBILE bodies are each flooded, in modern treating methods, with more than 4,000 gallons of solution before they are painted, according to V. M. Darsey, of the Parker Rust-Proof Company. This process, he said, produces on the metal surface a protective phosphate coating, which prevents corrosion and makes the paint stick better when applied. First introduced in 1936, when 850,000 bodies were treated, over 2,000,000 are undergoing the treatment this year.

OTTO BEECK, J. W. Givens, A. E. Smith and E. C. Williams, of the Shell Development Company, announced the discovery that certain chemical agents added to lubricating oils iron out microscopic rough spots on two contacting metal surfaces, and increase the wear-preventing properties of the oil many times. Even the best polish that can be given to metal parts by mechanical means leaves minute irregularities, and these engage with each other as one piece of metal slides against another. At these points, localized high temperatures are produced. With the new agents added to the lubricant, the metal is changed at these places to a low melting alloy which actually flows as the two tiny hills come together. "In other words," the report stated, "the surface of the metal is polished much like a roughened surface of hard wax might be polished by a hot iron. These chemical polishing agents are so chosen that the whole surface of the metal does not melt, or even grow hot, but only the minute projecting rough-

nesses. In this way the surface of the metal is polished to a high degree while in motion and by virtue of its motion.'' These agents, it was said, can produce an improvement of ten times in the lubricating qualities of oils. By the addition of another group of agents, consisting of long thread-like molecules, which increase the tightness by which a film of oil is held between moving parts, even under high loads, the improvement may be as much as seventeen times.

THE process by which invisible infra-red ''light'' is used to accelerate the baking of enamel on automobile bodies may be used in many other ways, was reported by J. L. McCloud, of the chemical and metallurgical department of the Ford Motor Company. These heat rays from special carbon filament electric lamps can be used to dry photographic film, to remove water from electrical parts and even to bake bread. As used in automobile manufacture, the car to which the finish has been applied is passed into a tunnel equipped with these lamps and gold-plated reflectors. In just a few minutes the finish is baked on as effectively as in an hour with the old ovens formerly used.

THREE new chemicals, naphthas that have important uses as solvents in lacquers and lacquer thinners used in automobile finishes, are now obtained from petroleum, which is coming to rival coal and coal tar as an important source of raw materials. Dr. W. J. Sweeney, associate director of the research division of the Esso Laboratories, and E. H. McArdle, of the Standard Oil Development Company, reported that until 1937 toluene, xylene and similar substances, derived from coal tar, were the chief materials used in this way. With paraffin as an intermediate product, the three new chemicals, each having qualities that adapt it to particular needs, have been obtained from the crude oil source. Copper napthenate, obtained by combining copper with napthenic acids which are minor constituents of nearly all petroleums, will protect wood, rope and canvas against dry rot, mildew and many marine growths, according to Drs. Edwin R. Littmann and J. M. Klotz, of Stanco Distributors, Inc. ''Solutions of copper naphthenate,'' he said, ''have high penetrating power and are quickly absorbed. When applied to wood, especially that which is in contact with the soil or subject to moisture or high humidity, the life of the wood is greatly prolonged. Fish nets, hand lines, ropes, etc., after treatment with copper naphthenate are highly resistant to rotting.''

GLASS-MAKING is being changed from an art to a science with the discovery announced by Dr. Maurice L. Huggins, of the Eastman Kodak Company Research Laboratories, of a method of predicting in advance the properties of glass of a certain composition. Previous efforts to do this have met only with partial success. The relationships are really quite simple if one consistently calculates both compositions and properties for the part of the glass which contains but a single oxygen atom. Using only a small number of constants, which he has computed for the elements generally found in glass, it is now possible to calculate accurately just what the glass will do to light passing through it. Formerly, it would have been necessary actually to make a sample of the glass to find its properties.

A METHOD of analysis employing fingerprints of molecules, which is so delicate that it can detect an impurity of a thousandth of one per cent. in a few drops of chemical solution, was described by Norman Wright, of the Dow Chemical Company, Midland, Mich. Furthermore, even those few drops can be returned unchanged after the test, for it consists in passing beams of invisible infra-red light through them. The method, known as infra-red spectroscopy, depends on the fact that highly complex molecules of organic chemicals, that is, those containing carbon, produce characteristic ''fingerprints'' or patterns when the infra-red rays are spread out into a spectrum. Glass can not be used to do this, because it is opaque to the rays. A two-pound prism of rock salt, however, separates the radiation into its various wave-lengths. If our eyes could see infra-red rays, we should view a spectrum, crossed by dark lines where certain wave-lengths are absorbed by the molecules. Since the rays are invisible and unable to affect even a photographic plate, they are detected with a thermopile, which measures their heating effect. This can detect a rise in temperature as small as a hundred-millionth of a degree. The analysis method consists in plotting the pattern made by the absorption bands, and comparing this with the pattern for known organic substances. When the two match, just as when two fingerprints match, it is known that the same individual produced them.

IF you cut down on meat this past summer in order to keep cool during the heat waves, you were on the wrong track, according to findings reported by Dr. E. B. Forbes, director of the Institute of Animal Nutrition, Pennsylvania State College. What you should have cut down was the total quantity of food, and particularly the starch, sugar and fat. Eaten all by themselves, protein foods like meat and fish cause a characteristically high by-product of body heat. Knowledge of this fact is what started the idea of eating less protein food in summer in order to keep cooler. When protein foods are eaten in a mixed diet, such as a meal of meat and vegetables, however, the relatively high heat production characteristic of protein eaten by itself is not in evidence in the sense that the heat production from the mixed diet is less than the sum of the separately determined heat increments of its constituent protein, carbohydrate and fat.

A GERM related to the one that turns milk sour has given a simple test for one of the newest of vitamins, pantothenic acid. Details of the test, which can be used for determining the amount of this vitamin in foods or the abundance or lack of it in a patient, were reported by Dr. F. M. Strong, R. E. Feeney and Ann C. Earle, of the College of Agriculture of the University of Wisconsin. New knowledge of human requirements of this vitamin may be obtained more quickly now that this test is available. The new test is said to be extremely sensitive as well as simple, and its speed appears from the report that 10 to 15 samples of food can be tested, or assayed, for pantothenic acid content in a day.—JAMES STOKLEY.

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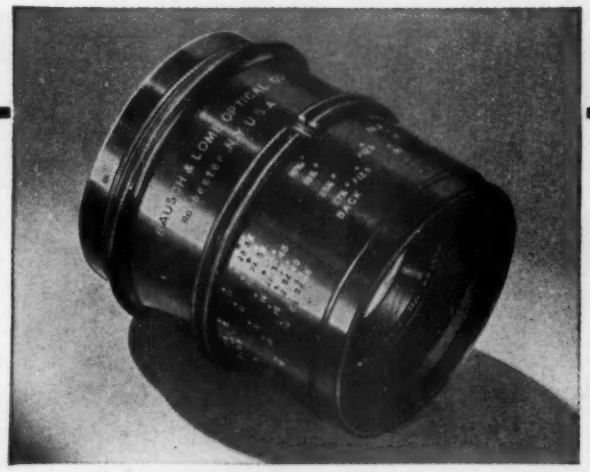

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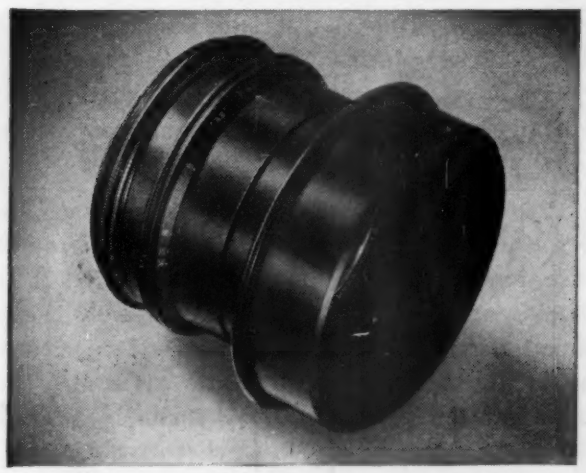

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The content has been broadened to include reference to, and in many cases brief discussion of the more important parasites of domestic animals. The new title of the book, with its subtitle "With Special Reference to the Parasites of Man," indicates the extended scope of the subject matter.

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SCIENCE NEWS

Science Service, Washington, D. C.

WELLESLEY COLLEGE MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

PRESERVATION of the framework, at least, for international cooperation among astronomers was urged by Dr. Robert G. Aitken, director emeritus of the Lick Observatory, in his address as retiring president of the American Astronomical Society.

"We must give thought," he said, "to the individual astronomers from war-torn countries who may find their way to this country; but this is part of a far larger problem involving the welfare of all professional men who are driven from home, and must be given over to some general organization like the American Association for the Advancement of Science, so far as scientific men are concerned. The astronomers will want to do their part generously, but particular care must be exercised that we do nothing to place in jeopardy the careers of the young astronomers trained in our own universities and observatories."

Giving full credit to the important work that can be done with telescopes like the 200-inch now being constructed, and even larger ones that may come in the future, Dr. Aitken emphasized that smaller star cameras, such as the Schmidt or Ross type, are needed for the solution of some of the most urgent present-day problems in astronomy, such as "the structure and rotation of the galaxy and the relation of our galaxy to others comprising the greater universe."

An important step in this direction was announced by Dr. Harlow Shapley, director of the Harvard College Observatory, who told the astronomers that a powerful Schmidt camera, larger than any now in use, is nearing completion at the Oak Ridge, Mass., station of his observatory. Erected in memory of Professor and Mrs. James R. Jewett, it is called the Jewett Memorial Telescope. The mounting, designed by Dr. George Z. Dimitroff, superintendent of the Oak Ridge station, was built in the observatory shops at Cambridge, and has now been placed. The glass parts, a concave mirror two feet across, and a correcting lens 33 inches in diameter that will be used in front of it, have been made by the Perkin-Elmer Corporation, and will be installed shortly. This telescope will be working in a month, he said, and will be used for counting stars and studying galaxies and variable stars.

Sun-spots, magnetic disturbances and northern lights they produce on the earth, have a bad effect on radio after they happen, but the transmission of wireless waves is particularly good for about a week before such outbursts, was stated by Dr. Harlan T. Stetson, of the Massachusetts Institute of Technology. Four days before the auroral display it is best.

Bad reception follows the aurora for about a week. It is worst two days after the aurora with broadcast waves, and at the same time for short waves used in transatlantic communication. Dr. Stetson attributed this effect to changes produced by the ultra-violet light of the sun in the ionizing layers which reflect long-distance radio waves back to earth again.

Most of Dr. Stetson's studies are made at Needham, Mass., where he records nightly the intensity of signals received from a broadcast station in Chicago. Such a distance is required so that waves will travel up to one of these reflecting layers, a hundred miles above ground, and be sent down again.

During the day, the station can not be received at all, but after sunset it begins, and gradually improves, as the sun descends farther below the horizon.—JAMES STOKLEY.

THE NEW VACCINE FOR MEASLES

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SUCCESS in vaccinating a small group of children against measles, which often leads to pneumonia and serious ear trouble, has been achieved by Dr. Joseph Stokes, Jr., of the University of Pennsylvania Medical School, and Dr. Geoffrey Rake, of the Squibb Institute for Medical Research, New Brunswick, N. J.

Army officials as well as parents throughout the land will hail this promise of triumph over measles, which was announced at the University of Pennsylvania Bicentennial Conference.

During the last World War, it was pointed out, measles became one of the commonest causes of death in the Army. This was because thousands of country lads who had never had measles due to their relative degree of isolation during childhood contracted the disease after they got into Army training camps. Many of them not only had measles but a severe and often fatal pneumonia as a complication of the measles.

The new anti-measles vaccine was made by growing the measles virus or germ on fertile hen's eggs. Apparently the virus becomes weakened or attenuated while growing in this environment and when injected under the skin or placed within the nose it produces a very mild type of measles in some children and no symptoms at all in others.

Two groups of children in New Jersey and Philadelphia, with the permission of their parents and health authorities, gave the new measles vaccine its first trials. None of the children had had measles. One group was vaccinated and the other was not. Both groups were then given injections of measles virus from patients who had measles. The unvaccinated children came down with measles, but the vaccinated ones did not. This was most encouraging, but Dr. Stokes pointed out that the number of children in these trials of the vaccine was too small to be entirely sure of the value of the vaccine.

Permission to make the tests was readily given by parents as well as health authorities because neither group of children ran very much danger. In the first place, they were all likely to get measles at some time in their lives, since 98 out of every 100 children are susceptible to it. In the second place, the trials were made in spring, the season when measles is least likely to be followed by ear trouble, pneumonia or other complications. Besides this, the children all had the best medical and nursing care.

Production of large amounts of the vaccine, it is said, will not be difficult and it can be preserved for long periods.—JANE STAFFORD.

CANCER PREVENTION; VITAMIN K

(Copyright, 1940, by Science Service)

VITAMIN K, the vitamin that is saving new-born babies and sick adults from bleeding to death, may be a help in preventing cancer.

Experiments to test this possibility are now under way, according to an announcement made by Dr. Louis F. Fieser, professor of chemistry at Harvard University, at the University of Pennsylvania Bicentennial Conference.

Vitamin K prevents bleeding in certain conditions because it favors production in the body of prothrombin, the blood constituent necessary to proper blood clotting. The chemical relationship between the vitamin and prothrombin, Dr. Fieser said, is similar in certain ways to a detoxifying of cancer-causing chemicals that has been observed in laboratory animals. "On the hypothesis that a cancer-producing hydrocarbon can be detoxified by interaction with suitable disulfide compounds it is conceivable that one of the normal functions of prothrombin may consist in the protection of the body from incidental carcinogens (cancer-causers). This would suggest the possibility that maintenance of prothrombin at the top level of activity by administration of vitamin K may produce a condition favorable to the inhibition of hydrocarbon carcinogenesis, and experiments to test this point are in progress."

The cancer-causing chemicals are coal-tar derivatives. London chimney sweeps were the first recognized victims of cancer from tar compounds. Such cancers are rare to-day, because the danger is known and can be avoided. Studies of the cancer-causing substances from tar, however, have shown that they are very similar to chemicals naturally found in the body, such as the bile acids and several hormones from the ductless glands.

Cancer may arise, according to one theory, from a defect in body chemistry by which cancer-causing chemicals, instead of harmless and useful ones, might be formed. Assuming that this might be the case, Dr. Fieser and associates have studied animals to see what might become of the chemicals. Rabbits fed some of the cancer-causing substances failed to get cancer and excreted from the kidneys what appeared to be detoxified derivatives of the original malignant compound. Study of the chemistry involved led Dr. Fieser to the theory of vitamin K as a possible protector against cancer that might be due to faulty body chemistry.

COAL AND OIL FROM PLANT CARBOHYDRATES

(Copyright, 1940, by Science Service)

FROM farms instead of mines and oil wells will come the coal and gasoline of the future, according to a prediction made by Dr. Ernst Berl, research professor at Carnegie Institute of Technology, at the one hundredth meeting of the American Chemical Society.

Already, in his laboratory, crude oil, bituminous coals, asphalts and coke have been produced from materials like corn, wood, seaweed, leaves and molasses. These are rich in compounds known as carbohydrates, of which starch and sugar are examples. The resulting coals, asphalts and oils, he said, have exactly the same properties as the natural products. So far anthracite coal has not been made, but this will be attempted in the near future.

Great advantage of the new process is that a fuel source is provided that can constantly be renewed. Nature's supplies of coal and oil are fixed. When exhausted they will not be replaced until untold ages have passed. Dr. Berl stated that he could make coal or oil from carbohydrates in from one to two hours. The method, he said, is "rather simple." It involves heating the carbohydrate materials under pressure with limestone. At present, it can not compete in price with crude oil obtained from the ground, but it is cheaper than making gasoline from coal by the hydrogenation process, which requires expensive high-pressure apparatus.

"In the United States at present there is no industrial interest in producing crude oil from cotton, wood, leaves, grass or molasses," said Dr. Berl, "but the time is not very far away when most of the easy-to-produce oil will be exhausted. Then, from all kinds of carbohydrate-containing raw materials, which the farmer can produce to a large extent, important amounts of asphalts and crude oils can be produced at prices which can certainly compete with other methods of the future. The transformation of carbohydrates furnishes an excellent liquid fuel which, thanks to the rather large amount of aromatic hydrocarbons, shows a rather high anti-knock value."

Estimates have been made that the United States possesses about 60 per cent. of the world's coal reserves and more than 50 per cent. of its oil reserves. "We have coal for perhaps 3,000 years and probably oil also for at least one generation," Dr. Berl continued. "In the future, when the low-priced crude oil will have been exhausted, methods like the distillation of oil shale and the hydrogenation of coal and carbon monoxide will be carried out. To these methods the production of different classes of substances with asphalt and crude oil properties from carbohydrates can be added. Especially in warmer climates carbohydrates are produced much in excess of what mankind would need for foodstuffs, textiles, explosives and lacquers."—JAMES STOKLEY.

NOTES ON PAPERS READ BEFORE THE AMERICAN CHEMICAL SOCIETY AT DETROIT

LARD, one of the oldest of shortenings for biscuits and pastry, can be kept fresh for from two to thirty times longer than usual by the addition of the fertility vitamin E or related synthetic chemicals, according to Dr. Calvin Golumbic, of the State University of Iowa. The excellent keeping qualities of vegetable oils, such as cottonseed and wheat germ oils, is apparently due to their rich supply of this vitamin. Lard and other animal fats which turn rancid easily are not rich in vitamin E. When the vitamin is removed from the vegetable oils, these behave like the animal fats in turning rancid rapidly. Even better than natural or synthetic vitamin E for keeping lard and other animal fats and oils fresh are the chemicals called chromans and coumarans.

ASCORBIC acid, otherwise known as vitamin C, which prevents scurvy, is twice as plentiful in strawberries as in orange juice, was reported by Mary Mann Kirk and Dr.

Donald K. Tressler, of the New York State Agricultural Experiment Station. Raspberries and turnips rank with tomatoes in vitamin C content, they stated; blueberries, plums and peaches contain smaller amounts; but scarcely a trace was found in blackberries, cherries and dewberries. Even the same fruit was found to vary greatly, for the skin contained two to four times as much proportionally as the meat. Because the weight of the skin is so small a percentage of the entire fruit, however, it actually supplies very little of the vitamin.

DR. M. A. JOSLYN, of the University of California Agricultural Experiment Station, reported that brown, discolored fruit is not only unpleasant to look at and frequently flat and flavorless to taste, but it also cheats you of the vitamins you are paying for. Dr. Joslyn has made a particular study of the kind of discoloration known as browning. This is a result of an oxidation reaction, in which vitamin C is destroyed along with the pigments that give the fruit its attractive coloration. In dried fruits, treatment with sulfur dioxide, long a standard practice for maintaining light color, was also found to check the lowering of the vitamin content.

SUPPOSEDLY necessary for all forms of animal life, vitamin A has been found entirely superfluous in at least one species—the common cockroach. Experiments demonstrating this were reported by Dr. C. M. McCay, of Cornell University, before the section on agricultural and food chemistry. A colony of cockroaches was kept on a diet known to contain no vitamin A. They should have sickened and died. Instead, they throve and multiplied in swarms. To make certain that they were not manufacturing the vitamin in their bodies, Dr. McCay made an extract from five pounds of the insects and fed it to rats kept on a vitamin-A-free diet. The rats developed all the symptoms of vitamin A deficiency. In another series of experiments, Dr. McCay discovered that for feeding trout in hatcheries, liver is a far better source of vitamin A than the cheaper ration of hog spleen commonly given to the fish. Apparently, to produce the healthiest trout for release into fishing streams, liver, though expensive, is still the best fish food.

SEAWEED is produced in immense quantities along all the world's seacoasts, yet very little of it gets used directly as human food. The Japanese make use of a jelly-like seaweed product known as agar, and in Europe a certain amount of a crisp and curly seaplant known as Irish moss is eaten. That is about all. In an effort to arrive at an estimate of the food values of these seaweed products, Dr. Hugo W. Nilson and J. W. Schaller, of the U. S. Fish and Wildlife Laboratory at College Park, Md., added graded percentages of both agar and Irish moss to the rations of young rats, weighing the animals to keep track of weight gains. They also made examinations to learn how much of the total seaweed fed was actually digested. The rats throve on most of the diets, though they did not gain weight any faster than control groups of animals fed on standard rations. The only notable exception was the group on a diet containing 10 per cent. agar; these gained 20 per cent. more weight than the controls. Rats receiving 20 per cent. Irish moss did badly: half of them died, and the survivors gained only about two thirds as much weight as the control animals. Both kinds of seaweed products absorb great quantities of water, so that the rats fed on them were very thirsty. They drank nearly twice as much water for every gram of weight gained, when 30 per cent. agar and 20 per cent. Irish moss were fed.

JAMES STOKLEY

ITEMS

THIS fall's first killing frost came a few days early, when the U. S. Weather Bureau station at Williston, N. D., reported a temperature of 31 degrees on the night of September 10. Normally, the first real frost of the season comes in the northern tier of states about September 15. The frost line commonly gets as far south as southern Minnesota and northern Nebraska by October 1. There will be a race between frost and the ripening of the corn crop. In Iowa only about one fourth of the crop is safe as yet, although warm, clear weather up until a few days ago caused encouraging progress. While the Northwest was experiencing its first chill nights, the extreme Southwest was still simmering in mid-summer heat. Early in the week a temperature of 108 degrees was reported from Phoenix, Ariz.

SILVER has multiple possibilities in the national defense program, according to a report made by Dr. Alexander Goetz, of the California Institute of Technology, to the American Mining Congress meeting in Colorado Springs. Tested potentialities range all the way from high-grade motor bearings to alloying with aluminum and magnesium in making light metal for aircraft construction. We may even eat our beans and sardines out of silver-lined cans instead of tin ones, if overseas sources of tin are cut off, Dr. Goetz stated. A sheet-steel base plated first with copper and then with silver makes a superior type of container. The silver coating need not be more than a millionth of an inch thick. The greatest immediate promise for large-scale use of silver, however, is in the field of disinfecting city water supplies. One part of silver in from 10 to 20 million parts of water will render the water safe for human consumption, even if it has been heavily infected. Costs should not be excessive—from $2 to $4 per million gallons of water. One present large use of silver is due to diminish. Methods for the recovery of hitherto wasted silver in the development of photographic films and prints, together with the rapid rise in favor of color photographs, are diminishing this outlet for the white metal, so that the discovery of other large-scale uses is desirable.

WILD morning-glories have become one of the most serious of weed pests in some parts of the corn belt; so much so, that banks and insurance companies decline loans on farms found to be infested with the smothering, strangling vines. They multiply at an amazing rate from the abundant seed which they produce, and once in the soil they are practically impossible to get out because they grow perennially from fleshy roots so deeply buried that only a trenching machine could reach them.

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SCIENCE NEWS

Science Service, Washington, D. C.

LIFE ON THE PLANET VENUS

LIFE on the planet Venus, under the clouds that perpetually veil its surface, now seems impossible, as a result of studies by Dr. Rupert Wildt, of the Princeton University Observatory. Dr. Wildt, who showed that Jupiter and Saturn are surrounded by clouds of ammonia, and that the atmosphere of these planets also contains methane, now advances the theory that the clouds of Venus are solidified formaldehyde. This is a poisonous and extremely irritating gas often used as a disinfectant because of its germ-killing powers. His results are announced in a paper to appear in the *Astrophysical Journal.* In this he proposes a theory to explain the origin of the formaldehyde and why it is not present in the atmosphere of the earth.

According to a suggestion made in 1924 by a German, Gustav Tammann, oxygen in our atmosphere originated when the surface of earth was in a molten state. The high temperatures, it is believed, caused the water vapor to break up into hydrogen and oxygen. The molecules of the former are in such rapid motion that they would have escaped into space. Some of the oxygen would have united chemically with the still molten crustal material. When this cooled and hardened some of the oxygen was left in the air.

On Venus there was originally a considerably smaller quantity of water vapor than on earth. Then, according to Dr. Wildt, the oxygen would be used up as fast as it formed, and when the crust solidified, there would be a thin atmosphere of water vapor remaining. Without earth's protection by its oxygen, the ultra-violet light from the sun would be much more intense. This would cause a reaction betweeen the water vapor and the carbon dioxide which has actually been found in the atmosphere of Venus. Result would be the formation of formaldehyde and liberation of more oxygen. But this, like the earlier supply, might also be used up as it unites with the crust. When all water vapor had been used up, the process would stop.

Last spring, while visiting the McDonald Observatory in Texas, Dr. Wildt made observations of Venus, comparing it with the airless moon, in an attempt to detect by the spectroscope formaldehyde in its atmosphere. Though if it were about a third of one per cent. as dense as our atmosphere it would have produced an effect, none was found. This, he states, does not invalidate the theory.

Formaldehyde molecules very readily combine into larger molecules, called "polyoxymethylenes," which are white solids. Therefore, it is suggested that this was the fate of the gaseous formaldehyde. These polyoxymethylenes also combine with water, so that if any water vapor remained they would have taken up the last of it. He refers to an experiment in which a minute amount of water vapor is injected into a jar of absolutely dry formaldehyde gas, made of single molecules. The jar is immediately filled with a cloud of the solid material in finely divided form. This, Dr. Wildt suggests, is the composition of the clouds over Venus. If this is the case there would still, in all probability, be enough free formaldehyde on the surface of Venus to make it most unpleasant, while the complete lack of oxygen would preclude the possibility of life.

CUNNINGHAM'S COMET

THE new Cunningham comet will probably be faintly visible to the naked eye in time to decorate the sky on Christmas eve, according to Leland E. Cunningham, who discovered it on a photograph made at the Harvard College Observatory. He has made a preliminary computation of its movement, based on three observations made on August 25 and on September 5 and 9, which indicates that it will be nearest the Sun on January 19, 1941. Then it will be less than three fifths as far from the Sun as we are, or about 36,000,000 miles.

Because of the bright moonlight the Harvard astronomers had not been able to make additional observations, since the comet is still quite faint, around the thirteenth magnitude. By the end of September it should be possible to make additional photographs. From these a more accurate orbit can be calculated. Then it will be known more definitely whether or not it will reach naked eye visibility.

The discovery plate was made at Oak Ridge on September 15 when the comet was recorded. It was also found on the other two plates made on August 25 and on September 9. On the latter, it appeared not as a mere hazy blob of light, but showed a definite nucleus and a small tail, indicating that it was approaching.

The comet is in the constellation Cygnus, the swan, which is directly overhead in the evening and is sometimes called the northern cross. Deneb is the bright star at the top of the cross—to the northeast. The comet has been moving westerly, north of Deneb, but Mr. Cunningham's figures indicate that it is turning toward the south.

The last comet visible to the naked eye was Hassel's, seen in April, 1939. Though of the third magnitude, quite bright, it was hard to find, because it was so close to the sun. The previous year was a very poor one for comets, but 1937 brought Finsler's comet, which was not conspicuous, but could be seen without a telescope during July. The summer of 1936 brought Peltier's comet, the discovery of an Ohio amateur, which also achieved naked eye visibility.

A later report states that the comet has been photographed at the U. S. Naval Observatory. The first picture was made on the night of September 18 with a star camera equipped with a ten-inch lens, by George M. Raynsford, of the observatory staff.

The comet is still so faint that Mr. Raynsford was not able to see it, even through the auxiliary telescope used for guiding. Therefore it was necessary for him to photograph it by "dead reckoning." Using predictions made by Mr. Cunningham, he was able to point the camera to the right part of the sky, and to move it during the one-hour time exposure in such a way as to follow the comet as it moved in that time against the background of stars.

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The resultant plate shows the comet with a faint tail and a definite nucleus. It is in the constellation Cygnus, the swan, overhead in the evening.

THE HURRICANE

THE recent hurricane that smashed across Nova Scotia and the famous 1938 hurricane that spread ruin in New England were storms off the beaten path of American weather. If meteorologists used such language they might describe these abnormal storms as "flukes."

Usually the immense masses of whirling air, born in the Atlantic near the Cape Verde Islands, come west to the Caribbean region and then rush up the Atlantic Coast. There they are forced out to the sea by masses of high pressure air over the mainland. They vent their fury on the ships at sea. Both Monday's storm and the New England hurricane were guided by two such masses of high pressure air, one inland and the other a stubborn high pressure area out to sea that channeled the storms toward land.

It is unfortunate that such a condition of the atmosphere forced the 1938 storm over New England and the storm over Nova Scotia with its teeming Halifax port so vital to British supply efforts.

Ordinarily, explained R. Hanson Weightman, of the U. S. Weather Bureau, high pressure over the northeastern section of the country pushes such a hurricane out to sea about the time it has traveled northwards along the coast as far as Cape Hatteras. Then it travels to the northeast and heads out to sea, where it is largely dissipated.

Once in a while, however, the high pressure area may move out to sea, and a channel is formed between it and one to the west. The air in a high tends to move counterclockwise. At the western edge of the trough the winds are from the north while at the eastern edge they are from the south, thus guiding the storm on its way. The work of the Weather Bureau is to time and plot the movements of these areas, and the hurricane track that moves with them.

The famous New England hurricane, which occurred two years ago, was guided by a very slow-moving high which remained off the coast, and caused the storm to move northerly, over the regions where so much damage was done. The conditions this year made the Nova Scotia hurricane move to the north northeast instead of northeast.

This seems to be a normal hurricane season, so far as numbers are concerned. Usually this period, from June to October, brings about a half dozen such storms.

CONSERVATION

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CONSERVATION in America requires a single viewpoint and a unified program, to put the support of all the people behind an understanding of all the problems and the rescue of all our resources, according to Professor Paul B. Sears, of Oberlin College, who spoke at the University of Pennsylvania Bicentennial Conference.

In the past, Professor Sears pointed out, separate groups have attacked small sectors of the conservation problem. Fishermen have tried to save and restore fish. Hunters have tried to save and restore game birds and animals. Foresters have tried to save the woods and plant new trees. And so on. However, each of these groups in turn has found itself forced to pass the narrow limits it set for itself: fisheries problems were found to step over into the fields of stream pollution and soil erosion; forests and wildlife were found to be inseparable. And over them all has impended the great weight of national and world changes.

Professor Sears continued: To meet the problem as a whole one must see it whole. He pointed out three ways in which a human community and its natural environment may be thrown out of balance: changing requirements of the community itself, depletion or disturbance wrought by its culture, and "natural" changes not caused by man.

Outstanding in the first class are changing habits of our civilization in food, housing, etc. Demands for more milk and vegetables, less heavy starches and meats, will cause shifts in place and type of farming, even in replacement of plowland by pasture. Rapid increase in the housing program can cause heavy drain on the surviving forests.

Highly developed civilizations, in all ages and lands, have tended to deplete resources, sometimes to the impoverishment or even the extinction of the culture itself. Thus, the ruinous floods of China, the desert and semi-desert condition of many Mediterranean lands, seem to be at least in part traceable to bad land management in the past, just as the dust storms of recent years in this country followed unwise plowing-up of grasslands in the West.

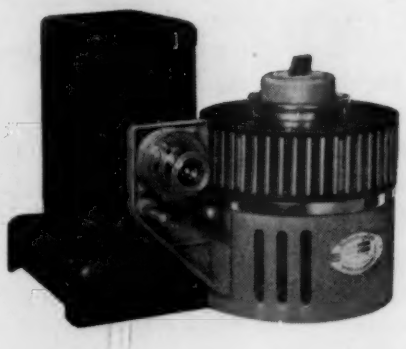
Gradual climatic changes have apparently played some part in the rise and fall of civilizations, though this is usually difficult to trace. As an example, Professor Sears cited evidence that the Mound-Builder culture moved into the upper Mississippi and Ohio valleys from the Southwest, along with an epoch of warmer, drier climate some centuries ago. Then, with the return of a cooler, moister climate the forest returned, and the Mound Builders were replaced by the Eastern, forest-dwelling tribes of Indians.—FRANK THONE and JANE STAFFORD.

MASTOIDITIS

THE greater prevalence of mastoiditis in the northern part of the United States is due to the cold climate which causes both lowered resistance to and greater virulence of the streptococcus, most commonly found germ in mastoiditis. This idea is advanced by Dr. Mercer G. Lynch, of New Orleans, in a report to the *Journal* of the American Medical Association.

Streptococci from different geographic regions and guinea pigs subjected to artificial climates typical of the North, the East and the South, were used in studies Dr. Lynch made to find why the number of cases of mastoiditis increases steadily from Texas and Florida to Massachusetts and Maine.

The streptococci were subjected to various temperatures of heat and cold such as are found throughout the country and also to sudden changes in temperatures characteristic of certain regions. Those germs from regions having such changes were more resistant than the germs taken from more uniform climates. The germs themselves, therefore,



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Dr. Lynch concludes, lose some of their virulence and living powers when accustomed to a more uniform climate. In time, however, those germs that survived the sudden changes became as virulent as the germs accustomed to such changes.

When the germs were injected into guinea pigs living in various types of artificial climates, it was found that the animals living in warmth and sunshine with plenty of calories and vitamins withstood even the most virulent germs from the North and East better than those living in cold climates with little sunlight and limited space for exercise, although this group of guinea pigs were injected with the less virulent germs from the Middle and Southern states.

From these experiments Dr. Lynch concludes that "those areas of the country where the climate varies markedly, where extremes of cold are encountered and where open air exercise is thus limited, over a period of time the resistance is lowered and the population is thus more susceptible to infection—this, coupled with the fact that the infection gains virulence because there is less in the natural elements to combat and decrease the virulence. By these factors are meant fresh air, sunlight and exercise."

DOUBLE MICROPHONE EFFECTS

BY combining two types of microphones, engineers of the Bell Telephone Laboratories have produced a new "mike" in which the direction of its sensitivity can quickly be changed. Already it has proved of value installed as part of the public address system in the House of Representatives in Washington. It has eliminated difficulties introduced by echoes from the marble walls.

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By introducing a resistance into the circuit of the moving coil, its sensitivity relative to the ribbon is reduced, and this gives the variety of patterns.

The new microphone has been tried in radio studios, where it permits the control of reverberation. When it is wanted to give the effect of space and distance, the reverberation can be increased, while at other times it may be reduced or eliminated.—JAMES STOKLEY.

ITEMS

BLUE prints or drawings may be invisibly mended with a film applied by an electrically heated instrument. The patch can be used on other papers as well. It does not become sticky even if heated.

A FILM of barium, a metal in the same chemical group as calcium, has been found to work as a lubricant in a vacuum where ordinary oil is useless. It has been tried inside an x-ray tube equipped with a rotating anode in order to give higher efficiency.

CARRIER Indians of Canada wear white man's rubber overshoes on their moccasins when it rains, and their dugout canoes are rigged with outboard motors. How civilization is coming to these Indians in British Columbia was observed this summer by Dr. Julian Steward, of the Smithsonian Institution. The chief object of his study was to probe the cultural borrowings of Carrier Indians long ago, when they got ideas of culture from more advanced Indians of the Pacific coast. Mingling with affluent fishing tribes, the primitive Carrier hunters took on the "potlatch system" whereby a chief must use resources of his estate to make feasts and give presents. Too poor to give away blankets by the dozen, a Carrier would cut up one blanket into small pieces to distribute. Carrier Indians are members of the great Athapascan Indian family.

BLOCKADE, and the absorption of medical men into military occupations, are seriously cutting down the number of foreign medical publications received in the United States, it is noted in the *Journal* of the American Medical Association. A check-up has been made in the library of the American Medical Association and in the publication office of the "Quarterly Cumulative Index Medicus." The last big shipment of Continental medical journals was received on May 27. Since that date only ten stray copies have come in, out of a list of some 1,400 different periodicals on the association's library subscription list. No Austrian or Italian publications have been received since June, and Polish and Czecho-Slovakian journals stopped coming many months ago. British publications continue to arrive, though usually somewhat delayed.

THAT deaf people are more acceptable to employers than any other job-seekers with a handicap, is the opinion of Mrs. Iris W. Booth, executive secretary of the Bureau for the Handicapped at Providence, R. I. Exceptions are the deaf who depend entirely on sign language, and who are therefore rarely able to fit into business or industrial niches, Mrs. Booth told the American Association to Promote the Teaching of Speech to the Deaf. In ten more years, she predicted, people who can not hear will be taught so universally to use their voices and read lips of speakers that there will be no problem of a sign language group, at all. The deaf, said Mrs. Booth, are no longer considered hard to get along with. Modern school training has stressed importance for deaf people of having pleasant and normal relationships with people who can hear. The deaf worker can almost always concentrate better than a worker with good hearing, and deaf workers can do heavy or light work, standing or sitting, unlike some types of handicapped job-seekers. Urging the value of vocational training, she said: "The employer, we have found through experience, will choose the properly trained handicapped person more quickly than the untrained able-bodied."

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SCIENCE NEWS

Science Service, Washington, D. C.

CHEMICAL TREATMENT TO INCREASE THE TRANSPARENCY OF GLASS

AT the Optical Society of America, Frank L. Jones and Howard J. Homer reported on their researches at the Mellon Institute, Pittsburgh, on the chemical treatment of glass surfaces, making them more transparent, which may have many important applications. Photographic lenses may be made faster in their operation, for example, or telescopes used at night by ships will gather more light and show a clearer view.

Previously, methods have been used for increasing the amount of light passing through lenses, thus decreasing the amount that they reflect, by applying thin films of another material. The method studied by Mr. Jones and Mr. Homer, however, treats the surface of the glass to form a film, by dissolving away the oxides from a thin layer. Such removal is possible without damage to the surface polish if the solvent does not dissolve silica. One of the best solvents found was a weak acid solution, such as one per cent. nitric acid, though solutions of salt, alkaline phosphates, melted salts and even water were found to show the effect.

Apparently it will hardly be safe for amateur photographers to attempt treating their own lenses without expert advice, for it was found that glass surfaces not freshly prepared reacted in an uneven fashion. After the surface film is once formed "it can be processed in various ways that will render the surface unreactive, so that a second treatment will not appreciably change the thickness of the film."

OLD PHONOGRAPH RECORDS

(*Copyright, 1940, by Science Service*)

IN a preview, in a tiny, crowded room at the Library of Congress, recently, engineers demonstrated that they can at last rejuvenate wax cylinder phonograph records of 40 years ago.

Not merely have they found a way to play safely thousands of frail cylinders on which scientists and musical archivists hopefully recorded folk music and primitive songs—and then stored the records away silent, afraid to play them even once. But the engineers have succeeded in making the music sound as it really was sung forty years ago, not the way the old tin-horn phonograph hoarsely croaked it out.

Among keenly interested participants in the demonstration was Percy Grainger, the composer and pianist. Nearly 300 cylinder records of folk music from all over the world, which Mr. Grainger himself recorded, about 1905 to 1908, will be transcribed to initiate the task of the Library of Congress of making old and silent records hearable. Mr. Grainger has kept his records unplayed.

The new machine, which will enable the American public to hear thousands of old American folk songs, Indian songs, and voices of personalities long deceased, is an invention from the Philco Company's laboratories. Produced in about two months' intensive research by Elmer O. Thompson, laboratory engineer, the machine transcribes the old cylinders without danger of scratching away valuable words or music, as ordinary needles would do in a few playings.

The machine represents use for the now familiar electric eye, or photo-electric cell. The photo-electric pick-up is placed on a standard dictaphone machine, replacing original equipment. The standard spindle is changed for one that will fit the commercial type of old Edison wax cylinder. The photo-electric pick-up is in turn connected to a Philco Home Recorder. Sound from the wax cylinder can thus be transcribed from the cylinder onto a flat disk type record, from which any number of additional impressions can be made.

Instead of the usual phonograph needle, which would gouge and destroy the sound groove of a frail cylinder, the device has a sapphire stylus which needs only to float gently in the grooves. As it does this, it sways a tiny mirror from six to seven thousandths of an inch thick. This mirror reflects light rays, directed on it by a tiny bulb, onto a photo-electric cell. The cell translates the light rays into energy which sets up the sound vibrations.

The new device reveals vividly that the weak feature of old-fashioned, scratchy, gurgling phonograph music was due, not to the recording itself, but to the reproducing machine. The horn was too small to reproduce the lower frequencies, and the mechanized part would not reproduce the upper frequencies. Listening to an old cylinder record of "Rocked in the Cradle of the Deep," as played on an old tin-horn phonograph, the quartet seemed to have trouble diving for low notes and voices faded in critical moments. The same record now transcribed to a flat disk and played with modern reproducing equipment shows that the quartet was not floundering, or suffering from a bad cold. The music is heard, as people of the early twentieth century had no chance to hear it—though it was there all the time on the cylinder.

One of his most valued sets of recordings, Mr. Grainger points out, is a set of the same complete songs sung by the same man on three different occasions. Available for close analysis at last, this rare musical record will show the kind of variations that occur in folk music, and features which are kept faithfully unchanged.

The Library of Congress hopes that Americans who have old cylinder records, of no use to them, may add them to the musical archives for study there.—EMILY C. DAVIS.

NEW ELECTRIC LAMP USING TELLURIUM AND OTHER RECENT PATENTS

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TELLURIUM, an element related to sulfur, discovered about a century and a half ago, and, though not rare, has so far found very few applications, is used in a new electric lamp. To its inventors, John W. Marden, East Orange, N. J., Norman C. Beese, Verona, N. J., and George Meister, Newark, N. J., the U. S. Patent Office has just granted U. S. Patent 2,215,648, one of 564 granted last

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week. Rights have been assigned to the Westinghouse Electric and Manufacturing Company. The inventors are connected with the Westinghouse Lamp Works, at Bloomfield, N. J.

Actual light comes from a glass tube shaped like an inverted J, contained in a larger bulb. The tube contains tellurium vapor. With a tube four inches long and a little more than a half inch in diameter, satisfactory operation was secured with two to three amperes of electrical current at 150 to 200 volts. A curious characteristic of the tellurium light is that it resembles that of a glowing solid more than of a glowing gas. The latter usually, when broken into a spectrum, shows a series of bright lines, but that from tellurium vapor shows more of a continuous spectrum. When operated at the correct voltage, its light is very close to daylight, so perhaps the lamp will have applicataions where artificial daylight is needed.

Other Westinghouse investigators recognized this week by the Patent Office were Dr. Edward U. Condon, assistant director of the Research Laboratory, in East Pittsburgh, Gereld L. Tawney and Willard A. Derr. This is a machine to play the game of "Nim," which, they say, "is to a certain extent similar to checkers." By a complicated system of electrical wiring the machine itself really plays against one or more players, the moves being shown by lamps on a screen above the apparatus. Rights for this patent, 2,215,544, are also assigned to the Westinghouse Company.

Daily changes in temperature from the cool of the night to the warmth of the day are used to furnish power in an invention by Michael Salvador Quinte, of Burbank, Calif. This was given patent 2,215,652. The air in an enclosed chamber expands as its temperature rises, which in turn changes the height of a level of liquid, and with it a float connected to a spring motor. As the changes in height occur, the motor is wound up, so that it can be used as a source of power. To make sure the device will work, even if temperature changes are not adequate, the patent provides for an electric heating element which can be used to warm the air.

A railroad freight car which can be removed from the tracks and made to serve as a trailer on the roads, pulled by a truck or tractor, is the invention of George T. Ronk, of Cedar Rapids, Iowa, which received patent 2,215,886.

Those who can not sleep in a Pullman car because of the click of the wheels as they pass from one rail to another, may benefit as a result of the invention of Thomas B. Maher, of Lynchburg, Va., granted patent 2,215,475. This is a joint which is made silent by connecting the rails to eliminate the click.—JAMES STOKLEY.

NEW WAY TO PICK PEOPLE NEAR NERVOUS COLLAPSE

A WAY to pick out the person who is approaching nervous breakdown and prevent that catastrophe may be found as the result of new research in the laboratory of psychology of Brown University.

Building on what has recently been discovered about the causes of nervous breakdown, and the comparisons in both rats and humans between "neurotic" and "normal" individuals, Dr. Frank W. Finger has gone back of the mental crisis. In experiments with rats, he has watched and measured the abnormalities of behavior that are preliminary to nervous disorder. He found out how a rat behaves when he has not collapsed, but is on the way toward nervous breakdown.

The rats in Dr. Finger's experiment are faced with a difficult problem of choice between two similar gray cards. If he jumps against one, it swings open to food. The other will not swing, and he gets a bump on the nose and falls. After each punished jump, Dr. Finger found, the rat will hesitate longer in making his choice, and will jump with greater force. This tendency increases when the difficulty increases and following each punishment. For a whole day following each trial, the rat is sluggish.

By measuring the time of hesitation and the force of the animal's jump, he was able to obtain, probably for the first time, a quantitative evaluation of what happens on the road to nervous breakdown.

If a similar measure can be found for changes in behavior of men and women faced with increasingly perplexing or unsolvable problems of life and continually punished by life's hard blows, it may be possible to help those who are approaching the breaking point.

HORSE SLEEPING SICKNESS

HOPE that specific remedies to treat sleeping sickness, infantile paralysis, and other virus diseases of the central nervous system can be developed appears in the new rabbit serum for treating the western strain of horse sleeping sickness announced by Dr. Joseph Zichis and Dr. Howard J. Shaughnessy, of the Illinois Department of Public Health, in the *Journal* of the American Medical Association. Men as well as horses are attacked by the form of sleeping sickness known technically as equine encephalomyelitis. Vaccines to protect horses from the disease have been used successfully, and at least one such vaccine suitable for protecting man has been developed.

A successful serum for treating the disease would be more practical than the vaccine, according to public health authorities, because so little is known about the spread of the disease that it is hard to determine where and when it will strike and who should be vaccinated. Vaccination of the entire population, of course, would be impractical, especially as human cases have not been very numerous.

The serum developed by the investigators of the Illinois Health Department from the blood of hyperimmune rabbits has given good results in treatment of mice and guinea pigs. Practically all the animals treated in the early stages and about two thirds of those treated in the later stages of the sickness recovered. No human trials are reported, though further studies of the serum are said to be in progress.

Serums for the treatment of other virus-caused diseases have been developed and used before this. In the case of diseases like the horse sleeping sickness, encephalitis and infantile paralysis, however, no success with serum treatment has been achieved. It was thought that this was because in these diseases the virus strikes nerve cells and the serum could not be got into contact with the virus in these cells. Examination of the brains of the treated animals that recovered showed that the virus had been

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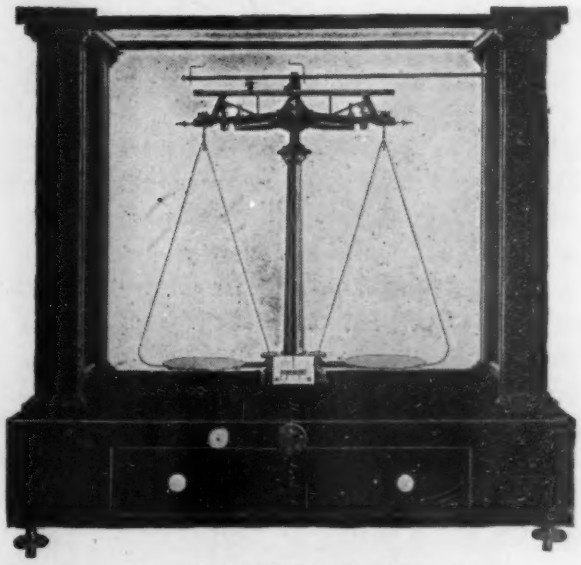

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spreading in and damaging the brain, but that its progress was checked by the serum. This gives hope that serums can be developed to check the damaging progress of other viruses that invade the brain and nervous system, though, of course, it may be some time before such serums are ready for use if they ever are.

Reason for the success in serum treatment of laboratory animals suffering with equine encephalomyelitis was the fact that a big enough dose was used. Contributing to the success also may be the use of rabbit serum instead of horse serum. The rabbit serum is believed to have smaller antibody (disease-fighting) molecules which probably can penetrate to the infected body tissues more rapidly.—JANE STAFFORD.

TREATMENT FOR CHRONIC SLEEPING SICKNESS

HOPE that a specific treatment for chronic sleeping sickness (encephalitis) will eventually be discovered appears in a report to the American Medical Association of studies of the brain of Patricia Maguire, of Oak Park, Ill. The girl, who fought a five-year losing fight against this ailment, attracting nation-wide attention before her death three years ago, may thus some day be included in the group of medical martyrs whose sufferings contributed to better methods of disease-fighting. The origin of pathologic, as opposed to normal, sleep seems also to be clarified by studies of the brain of this victim of such a sleep disorder.

Post-mortem study of her brain, according to Dr. Richard B. Richter and Dr. Eugene F. Traut, of Chicago, show conditions which it is believed could only be caused by a chronic infection, and not as the result of a progressive process of brain tissue change, set off by an original acute infection.

The latter view of chronic encephalitis as a progressive process following acute infection has gained increasing support in recent years. Findings showing that it is more likely an inflammatory process suggest that a means of treating chronic encephalitis or sleeping sickness may eventually be found because inflammatory conditions may lend themselves to treatment. The present method of treating the condition is to treat each symptom as it arises.

The injury responsible for production of abnormal sleep in humans as well as in animals is, reported from the findings on Miss Maguire's brain, damage to the rear part of the hypothalamus region of the brain. Details of these studies appear in the October issue of the *Archives of Neurology and Psychiatry*.

ITEMS

EAGLES are always an attraction in any zoological park's aviary. So rare that it is doubtful if the average zoogoer ever heard of it, is the monkey-eating eagle of Africa. The National Zoological Park in Washington, D. C., is fortunate in the acquisition of a pair of these birds, brought back from Liberia by Dr. and Mrs. William M. Mann. They are believed to be the only pair of monkey-eating eagles now on display in this country.

CORN has apparently won its race with frost, it is indicated in reports from all over the country received at U. S. Weather Bureau headquarters. In the northern part of the Corn Belt, as represented by Minnesota, frost has already come, but the corn was ripe ahead of its arrival. In Illinois three fourths of the crop is now safe, and in Iowa more than four fifths can no longer be harmed by even a heavy frost. This is stated to be 23 per cent. more than average and about ten days earlier than a normal year. In the South, cotton bolls are opening rapidly and picking is making excellent progress, except where interfered with by heavy rains. Although the rains may interfere with farm work in parts of the great central valley they bring welcome relief from the threat of drouth to many localities. Rain is particularly welcome in parts of the winter wheat belt, where lack of soil moisture has been causing some concern.

IN many kinds of scientific work, a very constant source of light is needed, but with an electric lamp, variations in the current supplied to it may cause considerable changes in the light intensity. Harold Stewart, of the University of Rochester, speaking before the American Optical Society, stated that he had used a special regulator. The voltage of the incoming electricity varied by several per cent., but the regulator cut it down to about 1/400 of one per cent. Even then, he said, the output of light varied more than 1/10 of a per cent., due to causes within the lamp itself. By arranging an electric eye to watch the lamp and, in turn, control the electron tubes in the voltage regulator, he was able to secure light of more constant intensity.

LAURENS HAMMOND, inventor of the electric organ and the novachord, has given the music trades a third electrical instrument on which any one may play a melody simulating any sort of instrument while accompanying himself on the piano. The new device, called a "solovox," consists of a three-octave keyboard instrument to be clipped to the underside of the piano keyboard so that its keys are just below the level of the piano keys. Thus the pianist's right hand can play keys on either the piano or the solovox. The solovox keys operate electrically, by setting up minute oscillations in radio tubes that are in a separate box set off to one side through the usual cable connections and loud speakers. The solovox will not play chords, being so connected that it will sound only one note at a time. On the front of the keyboard, however, are a dozen controls with which the tone of the solovox can be altered to simulate the quality of almost any musical instrument, while a knee-operated lever controls volume.

IT has been found that a marsh can be greatly improved as a home for water-loving wildlife species by blasting openings in the thickly matted vegetation, making small ponds where ducks and geese can swim. Experiments in the creation of such small water areas in a bulrush-cattail marsh near Jewell, Iowa, will be reported in the October issue of the *Journal* of Wildlife Management by Thomas G. Scott, of the U. S. Biological Survey, and W. L. Dever, of E. I. du Pont de Nemours and Company.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SOLAR ECLIPSE

EVEN though they chose a location in a very dry as well as high region of South America, where the chances for good weather seemed extremely favorable, cloudy weather curtailed the observations of the joint expedition to Patos, Brazil, of the National Bureau of Standards and the National Geographic Society, to observe the total solar eclipse visible on October 1.

A report received from Dr. Irvine C. Gardner, leader of the party, says that the eclipse itself was eclipsed by the clouds. Thus, the elaborate equipment, weighing about seven and a half tons, which they transported from Washington, was largely useless. No opportunity was given to try the control device, operated like an electric player piano, which had been arranged to operate the various cameras automatically, so as to give the astronomers the opportunity to watch the events in the sky.

This expedition, however, was better off than many others in the past, for which cloudy weather has meant complete failure to secure useful results. One of the main items on the program was a study of the way that the transmission of radio waves through the upper layers of the atmosphere is changed as the moon's shadow goes by. This is unaffected by clouds, and these observations were made satisfactorily. The actual results will not be known until after careful study of the data. Hopes that at least one astronomical group had been successful were considerably lessened when word was received from Dr. Charles H. Smiley, of Brown University, that clouds over Curema, Brazil, had prevented his planned observation from that distant spot. He had planned to take photographs at Curema with a special type of star camera, known as a Schwarzchild telescope. With this he hoped to record the zodiacal light, a faint glow sometimes seen near the sun. Accompanying him was Dr. Alice Farnsworth, of Mount Holyoke College, who was to use other equipment, including a spectroscopic camera, for further observations. Dr. Smiley's report, which was delayed because of the remoteness of Curema, says that all the films were exposed, though he is certain they will be of little value.

No word had been received so far from the Cruft Laboratory of Harvard University concerning the expedition to Queenstown, South Africa, to make radio observations. The expedition, under the direction of Dr. J. A. Pierce, is now in the middle of a three-months' program to study the effect of the eclipse on radio transmission before, during and after the time the moon passed in front of the sun. Since this is unaffected by clouds, it is assumed that the observations were carried out as planned. A motion picture of the eclipse was planned, incidentally, mainly to give a record of the extent to which the moon covered the sun, for checking with the radio data. If this was taken, it may have considerable value as one of the few photographic records made of this eclipse.

There are, however, several large observatories in South Africa. It is quite likely that some members of their staffs made an effort to observe the eclipse, for it is hard to imagine an astronomer neglecting one so near home. On account of the war, it may be some time before news of any such results reaches the United States.

With the total eclipse of October 1 past, and observations, in South America at least, ruined by clouds, astronomers are turning to their reference works to see when they will have another chance. This will come on September 21, 1941, though plans are very uncertain, because the best place from which to see it will be on the coast of China, between Foochow and Wenchow, as well as farther inland, at Hankow and Nanchang. Whether foreign astronomers, especially Americans, will be able to set up their instruments there by next September is perhaps rather questionable.

The tip of the moon's shadow, on September 21, will first touch earth at sunrise in Russia near Astrakhan. Then it will cross the Caspian Sea, the Aral Sea, Turkestan, Tibet and China. After that it will pass across the western Pacific Ocean, including the American island of Guam. Here the sun will be blacked out for about two and a half minutes, or fifty seconds less than in China, but this would still give time for many valuable observations.

SUSCEPTIBILITY OF INFANTILE PARALYSIS

(Copyright, 1940, by Science Service)

LARGE-SCALE tests of the population for susceptibility to infantile paralysis may soon get under way as a result of research, according to a report by Dr. Charles Armstrong, of the U. S. National Institute of Health, made at the meeting of the American Public Health Association at Detroit.

Dr. Armstrong's discovery that mice and cotton rats instead of the more expensive monkeys can be used for testing a person's immunity or lack of it to the disease would make such mass tests possible. Search for a possible chemical remedy will also be advanced through this discovery.

The still unsolved mystery of why older persons and those living in institutions generally develop resistance to infantile paralysis may be explained by making tests on large numbers of the population. With monkeys only a few immunity tests can be made because of the expense. The largest number made in one study with monkeys was about eighty, whereas Dr. Armstrong has already made 293 since discovering that cotton rats and mice can be used.

The test consists in mixing serum from the tested person's blood with infantile paralysis virus and injecting it into the rat or mouse or monkey. If the animal fails to get the disease, the person's blood contained virus-neutralizing material, indicating immunity to the disease. Heretofore only monkeys were used because no other animal had been found susceptible to the disease except man and monkeys.

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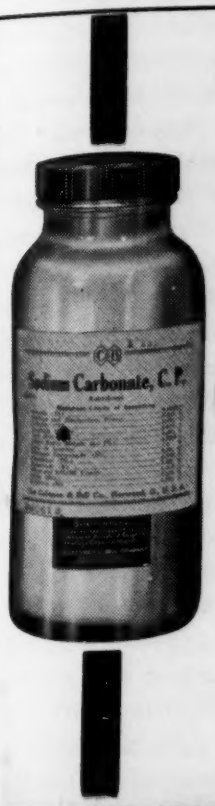

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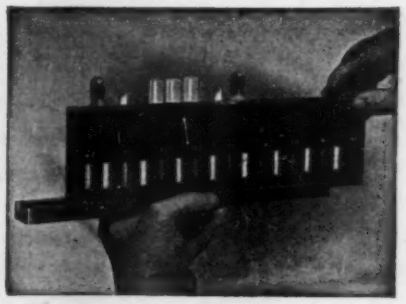

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their histories of almost unnoticed illnesses such as slight colds, or of contacts with infantile paralysis patients would also shed light on the question of how and why some people acquire immunity or resistance to this disease while others do not.

If resistance is acquired through age alone, as has been suggested by recent experiments, and not by building up resistance through a sort of natural vaccination with small doses of the virus, the mouse or cotton rat tests might show the exact age at which immunity does develop. Then a study could be made of other changes occurring at an age which might carry with them ability to develop resistance to infantile paralysis and from this, possibly, develop a means of protecting against the disease at any age.—JANE STAFFORD.

ANTI-SYPHILIS LEAFLET

AS part of a new drive on syphilis and gonorrhea initiated by the U. S. Public Health Service, each of the 16,500,000 young men who register on October 16 for America's first peacetime draft will be given a leaflet urging that he take a blood test as part of an initial check on his physical fitness. Surgeon-General Thomas Parran pointed out that registrants for the draft make up the age group in which is concentrated most cases of infectious syphilis.

"Blood tests of this group," he said, "will lead to the discovery of a large number of cases of syphilis in the stage of the disease during which treatment is most effective. Stopping the spread of syphilis among this group would bring the control of syphilis among the whole population nearer by many years."

Making a blood test of each man as he registers was suggested at a conference of state health officers with the surgeon-general. This would be impractical with the available facilities. It would keep every laboratory in the country busy for a year testing the 16,500,000 samples of blood and satisfactory tests can not be made on blood after it has been kept for several months. The time is too short to prepare for such a speed-up in laboratory work as would be necessary, but it is hoped to achieve the same results through the leaflets telling each of the registrants the facts about syphilis and gonorrhea and their relation to national defense. Dr. Parran pointed out that "Men infected with syphilis or gonorrhea and untreated can not efficiently perform their duty of defending America. Discovery and treatment of syphilis among registrants *now* will increase the reservoir of men available for active and efficient duty in the armed forces and in industry. An educational campaign coordinated with an extensive blood-testing program will not only discover many hidden cases, but with the facts about syphilis in the hands of all young men between 21 and 36, we may expect a reduction in the number of new infections."

EYE TESTS IN THE INDUSTRIES

NEW eye tests to protect the vision and speed the efficiency of workers in defense and other industries were announced by Dr. Hedwig S. Kuhn, of Hammond, Ind., at the meeting in Cleveland of the American Academy of Ophthalmology and Otolaryngology.

The tests, a new instrument for giving some of them, and the idea that workers must be selected for jobs on the basis of their eyesight as well as other requirements developed from Dr. Kuhn's study of 16,000 workers in such diverse industries as "chemicals, big steel and little steel, soap, public utilities, textiles, tanks and even horse shoes."

This is apparently the first scientific study of the demands that modern machinery makes on the eyes of workers. Five groups of eye defects and their significance were discovered in studies of occupations in which the visual requirements differed markedly. At one extreme of those studied was a crane operator who needed to judge distances 150 feet away; at the other a "looper" in a hosiery factory whose pay envelope depended on her ability to do piece work 8 inches from her eyes.

"To find acuity defects and a lack of depth perception is of vital importance for crane operators, but of no special concern to manual labor," Dr. Kuhn pointed out. "A marked muscle imbalance in clerical workers has been shown to be detrimental to their comfort and efficiency, while an extremely careful study of the five defect groups is essential in choosing or analyzing girls in looping at a distance of 8 inches. For the purposes of industry this type of practical analysis is the basis for deciding where to begin a personnel program of shifting jobs, and an insistence on corrective measures."

PLASTICS

WITH the old supply of harmonicas from Germany, Italy and Czecho-Slovakia cut off by the war, a shortage of these instruments threatened, but now a molded plastic mouth organ has been made in the United States. It is one of nearly a thousand exhibits now on display at the Chanin Building, New York, which show the great variety of products made from synthetic materials. These exhibits have been entered in the Fifth Annual Modern Plastics Competition sponsored by the magazine, *Modern Plastics*.

Another novel application is a football helmet, with a molded plastic shell, lined with padding. It can be made in a great variety of colors and is said to afford more comfort, protection and a better appearance than the older type. Whether it will appear this autumn on the nation's gridirons may be determined after football experts have given it a test.

Women's shoes and raincoats are among the articles of clothing of plastic. For the former, the flexible plastic material is used mainly as a comfort-promoting and decorative feature, though its use later for soles is anticipated. Availability in clear, transparent form as well as in colors adapts it to open heel and toe models, where it gives protection without destroying the effect.

Porch and terrace furniture is shown, made of plastic strands, woven by hand or machine. Unlike rattan and wicker, this is unaffected by the elements, and does not unravel to make a rough surface, which may tear clothing. It can be washed with soap and water.

An important industrial application is a plastic solder paddle used in finishing automobile bodies. These are used to smooth the hot lead solder. The wooden paddles formerly used had to be replaced frequently. The plastic

paddles withstand the temperature of the molten lead, and have in their handles a fountain of oil, which can be released to assist in the smoothing operation.

Another industrial device is a brush used to convey dyes from shallow vats to engraved rolls which in turn print designs on fabric. Formerly, Mexican cactus fibers were used for the bristles, and the life of a brush ranged from two to eight weeks. Bristles of the new brushes are made from the same synthetic fiber that women have recently started to wear for stockings, and they have now been in operation for over eight months without a breakdown.

Boat owners will be interested in a bilge pump completely enclosed in a strong plastic housing. It has a sway-proof switch. Even though the boat is rolling, it stays on until the bilge is pumped dry.

In not all uses of plastics are they visible. Panels of plywood are shown in which the veneers are bound together by a synthetic resin. This is a bond that is unaffected by moisture, temperature, acids or insects.

LUMINOUS BRICKS

HOLLOW glass bricks for construction of houses and other buildings, which admit daylight during those hours, and glow at night when electricity is passed through them, may soon give architects an entirely new angle on illumination.

The luminous bricks, invented by Edward B. Baker, of Detroit, Mich., won for him patent No. 2,216,220, one of a total of 612 patents for new inventions granted this week. Rights have been assigned to the General Electric Company.

Many modern buildings have used glass bricks in recent years, but Mr. Baker's improvement is to fill them with a gas that becomes luminous when an electric current passes through them. He lists some advantages as follows:

"With a wall of this nature, the intensity of the light per unit of area is much lower than is the case with a few spaced light sources of high intensity and a closer approach to indirect illumination may be achieved. In a room having the walls built up in this fashion, an adequate quantity of light may be obtained without having any bright spots to produce an annoying glare. Moreover, when used as an outside wall, a room of this nature would be quite adequately illuminated during the day, due to the translucent nature of the wall. Another advantage of such a structure is that since the wall is itself luminous no separate light supporting devices need be provided. Moreover, since the internal pressure is quite low each of the individual blocks functions as a very good heat insulator."

In order to increase the illumination, he suggests that the inside of the bricks be coated with a material, like that used in the new fluorescent lighting units, which glows under the influence of the ultra-violet rays generated by the electrically excited gases. If ultra-violet rays are wanted in the room, as for sterilizing purposes, the brick can be made of a glass which transmits them, and a small amount of mercury placed inside the brick.

ITEMS

CONSTRUCTION of the sixteenth American cyclotron, powerful tool for the study of cores of atoms and the creation of radium-like substances artificially, is in progress at the University of Illinois. Six iron castings weighing 60 tons have been installed on a concrete base in the new Radiation Laboratory. On them has been placed two miles of copper tubing, wound into a dozen flat coils. The university already has a small cyclotron, second in the world, built soon after Dr. E. O. Lawrence made the first at the University of California. The new one will, it is said, "be roughly equivalent in results" to any of the others now in operation or being constructed in America.

IF you fix your eyes on a stationary point along the path of a speeding automobile, apparently you can see the spokes of the rapidly spinning wheels. But this effect is really an illusion. This was explained at the meeting of the Optical Society of America by William A. Gardner, of Columbia University, who has reproduced the effect by photography with a slow shutter speed. Actually, one does not see the spokes themselves but each spoke, as it turns over and moves forward at the same time, produces a broad, blurred curve. Where these curves have the greatest over-lap, a pattern of radial lines is formed which looks like the real spokes. This pattern glides across the retina of the eye or the film of the camera. A previous explanation of the effect has been a "stroboscopic" theory of vision, that the eye sees in instantaneous pulses somewhat like the successive pictures in a movie film. Mr. Gardner points out that his results, and the fact that he has photographed the effect, favor the alternate theory, that the sensitivity of the eye is continuous, like the camera film. There is a similar phenomenon, called the Roget effect after its discoverer, by which the spokes of a moving wheel appear curved when seen through a series of fixed vertical slits. Mr. Gardner has reproduced this photographically also.

KIWIS, wingless birds whose name is tossed as an epithet by aviators at the non-flying ground officers of their service, are now represented in a new exhibit at the Field Museum of Natural History, Chicago. The group shows a kiwi standing guard over two disproportionately large eggs in its nest under a cycad bush. The kiwi, a native of New Zealand, is one of the strangest-looking birds now living. Its wings have degenerated to mere internal nubbins of bone, its body is covered with long, fringy feathers that look almost like hair, and it has a long bill which it uses in probing for worms and in tapping, like a blind man, to guide it on its weak-sighted way. It is about the size of a hen, but its eggs are ten times the size of hens' eggs. They weigh a fourth as much as the bird that lays them. In the kiwi family, it is the female bird that rules the roost. The male, a third smaller than his mate, meekly sits on the eggs and broods the chicks. The hen takes over the defense of the nest if an intruder threatens. She kicks straight forward, like an ostrich, with her unfemininely large and strong feet, and since her toenails are hard and sharp she can inflict really nasty wounds.

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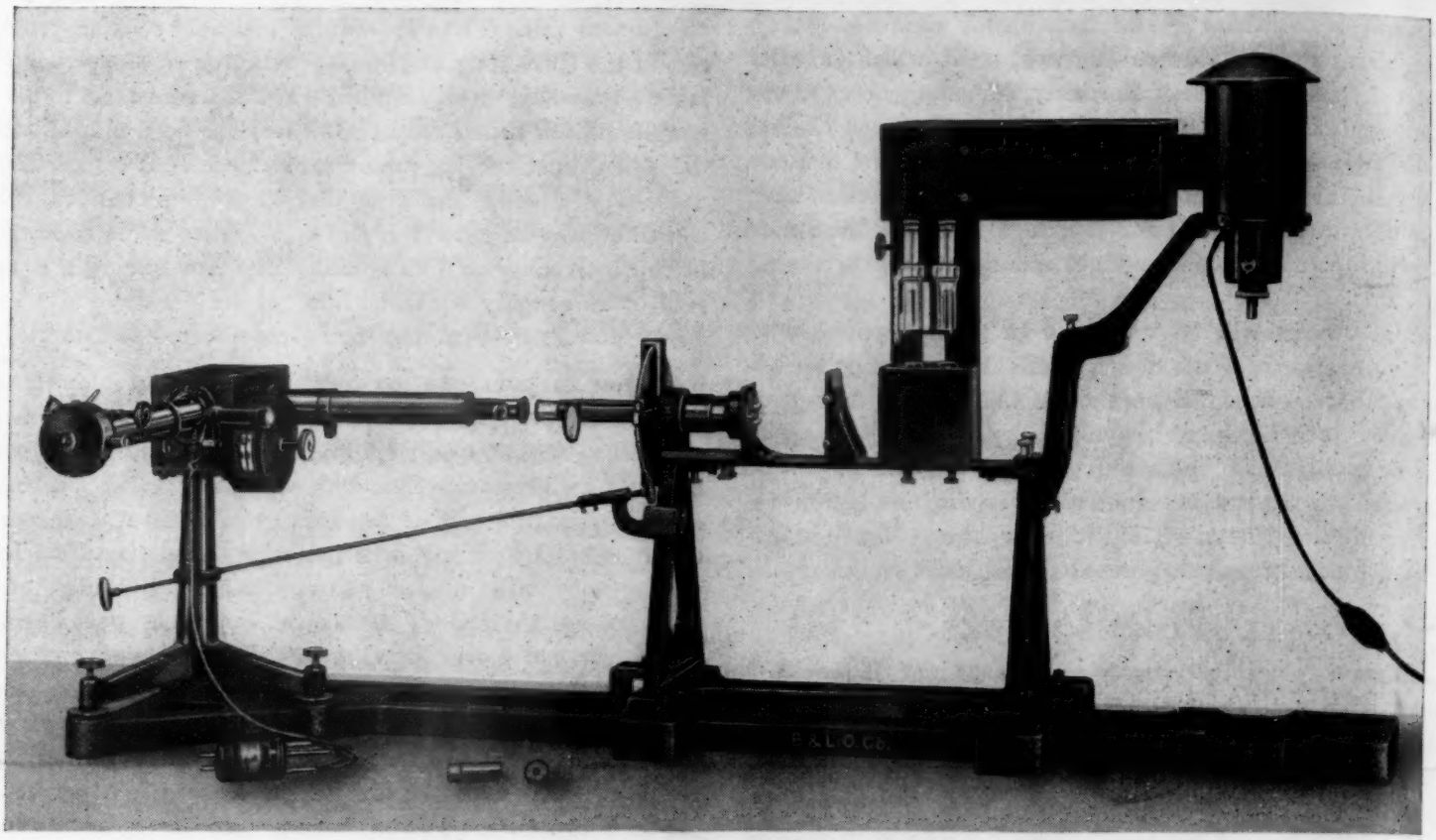

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By **ASA C. CHANDLER**, *Professor of Biology, The Rice Institute*

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Published October, 1940; 698 pages; 6 by 9; 309 illustrations; $5.00

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SCIENCE NEWS

Science Service, Washington, D. C.

HEALTH PREPAREDNESS

POINTING out that "we have a tremendous task ahead of us," the new president of the American Public Health Association, Dr. W. S. Leathers, of Vanderbilt University School of Medicine, at the recent meeting in Detroit, urged public health workers to greater efforts on behalf of health preparedness.

In his presidential address Dr. Leathers said that during a period of national emergency, industry will be working under high pressure. Many hazardous chemicals will be used; overcrowding will occur and poor housing and sanitary conditions may become acute problems. This situation will require constant vigilance on the part of public health workers, and especially of industrial physicians.

He pointed out that the National Institute of Health, with its division of industrial hygiene, is in a position to coordinate a national program of industrial health. Sanitary measures around army camps can be better established and better enforced where there is thorough coordination between state and local health agencies and the military population.

The present war is a "war on nerves," said Dr. Leathers, stressing the weakening dangers of faulty diet. Among lessons of the World War which stand out now, he cited the fact that approximately a third of the men examined for World War service were physically unfit for military duty during one of the most critical periods of our country's history. "This experience alone," he added, "should cause us to make a dynamic drive for health preparedness."

Warning of the likelihood of another pandemic of influenza in the near future, Dr. Leathers urged research workers to intensify efforts to find a way of immunizing people effectively against this disease. Both measles and influenza were public health problems of the last war, and were all too frequently followed by pneumonia. Repetition of the "alarming" pneumonia death rate in the last war can be avoided now, however, as a result of recent knowledge for its prevention and cure. In this connection, he called the discovery of sulfapyridine "the greatest boon to pneumonia therapy that has occurred in the present century."

He expressed the view that Congress should pass the recently introduced bill for control of common colds, influenza and pneumonia, not only as an essential national defense measure but also as a great human need. The bill, which carries $3,000,000, would enable states campaigning against pneumonia to provide better medical supervision, more technical aid, increased number of typing stations, and an increased supply of sulfapyridine and specific sera.

As another urgent need Dr. Leathers called upon workers to devise "a synthetic preparation as a true prophylactic against malaria." In the last war, each cantonment in the South was guarded by an antimalarial zone a mile wide, and the U. S. Public Health Service and state and local health departments all worked together to fight this disease. Fortunately, even better methods of mosquito control are now known, but there are still serious limitations in treating malaria.

Venereal disease—which attacked more men in the army and navy in the last war than the number wounded in battle—can be reduced to a negligible health problem, like typhoid fever, declared Dr. Leathers, "if we have the will and the wisdom to do it."

Calling the Venereal Disease Act of 1938 one of the three most important health measures enacted by the Congress in the past decade, he said that the appropriation for 1940 is $6,200,000 and sharply pointed out that no nation can afford to save money by discontinuing the sustained fight on this major disease.

HEALTH PROTECTION AND ARMY TRAINING CAMPS

(*Copyright, 1940, by Science Service*)

HEALTH protection of persons living near the new Army training camps will have to be given by state and local health authorities without federal financial assistance to meet the extra load of work, according to Assistant Surgeon-General Warren F. Draper, U. S. Public Health Service, speaking before the International Society of Medical Health Officers meeting at Detroit.

Congress has refused to make an appropriation to the Public Health Service at this time which would enable the service to aid local resources, because within the last four years considerable grants-in-aid have been made through the Public Health Service to the states to increase local health services. These grants have amounted to $11,000,000 annually, plus $6,000,000 annually for venereal disease control.

Population around the peacetime training camps will suddenly increase by a third or a half or may even be doubled, if World War training camp experience is repeated. The population increase will be made of construction workers and their families, job-hunters, families of the trainees, and a miscellaneous hodge-podge of camp followers. Hotels, boarding houses, restaurants, ice cream parlors and bottling establishments will be overtaxed and cleanliness and sanitation are likely to suffer. In addition, the military forces may have to depend on local water supplies and sewage disposal facilities.

Unless this extra strain on local health protection resources is foreseen and provided for, disease is likely to break out around the encampment areas. Although Dr. Draper did not enumerate specific diseases, health officers listening to him knew that typhoid fever, dysentery, trench mouth, colds, influenza and pneumonia are among the dangers that threaten unless proper sanitary and health measures can be taken. To assist in this task, Dr. Draper said, the U. S. Public Health Service can send to encampment areas trained advisers or consultants. These men will have the confidence of the military authorities and so can act effectively as liaison workers between military and civil health authorities.

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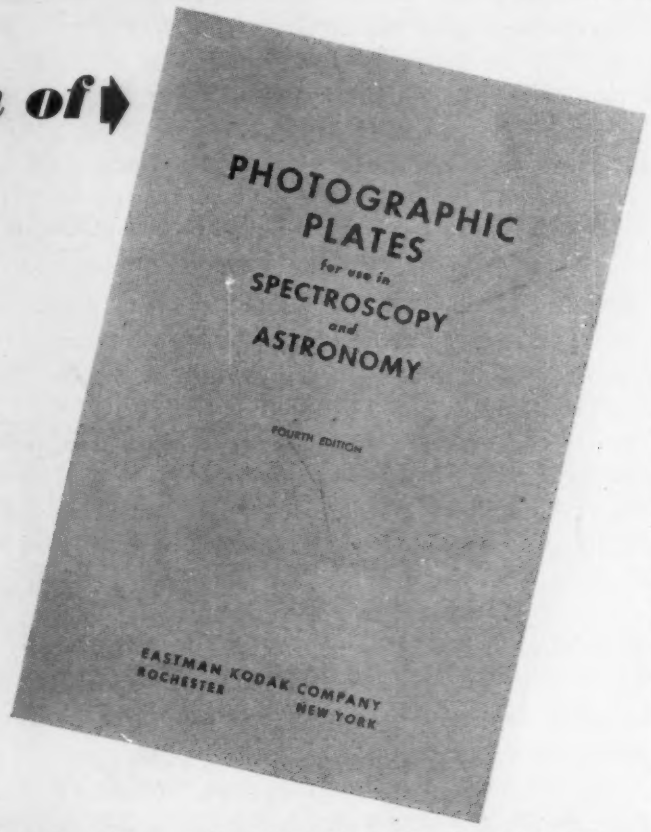

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In brief, the booklet contains full details of the important characteristics of some 60 kinds of special plates for scientific work, covering the spectrum from the short ultraviolet to the infrared at λ12,000 A. A copy of it will be sent free on request.

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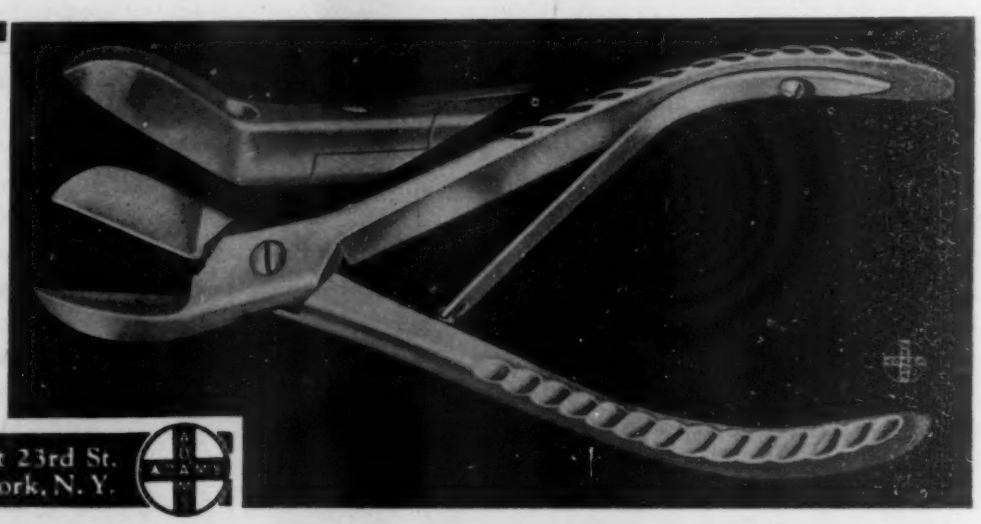

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day or more will health departments be able to take care of the extra strain without sacrificing other vital health services, was pointed out by Dr. Arthur McCormack, Kentucky state health commissioner. Even if health departments could get money to finance the extra work the training camps will bring, they would not be able to get trained workers immediately.—JANE STAFFORD.

A NEW TREATMENT FOR SILICOSIS

(*Copyright, 1940, by Science Service*)

HOPEFUL news of the first clinical trials of a new treatment for silicosis was brought by Dr. D. Irwin, of the University of Toronto, to the American Public Health Association meeting in Detroit.

For the past six weeks some seven or eight men, perhaps more by now, have been having their lungs dusted daily with aluminum powder in the hope of checking further ravages of their lungs by the silica dust they have been breathing while at work. The treatment is being given by Dr. D. Crombie, superintendent of the Queen Alexandria Sanitarium in London, and Dr. J. Blaisdell. At least a year will be required before the results of the treatment can be determined, but the signs so far are "far from discouraging," Dr. Irwin said.

The men inhale the aluminum dust through a tube held in the mouth, exhaling through the nose. The treatments start with a two-minute daily inhalation and work up to a thirty-minute inhalation every day. The men are continuing with their work while under treatment. Tests of lung function, developed by Professor W. S. McCann, of Rochester, N. Y., were made before the start of treatment and will be made at intervals during the trial year of the treatment. It is hoped that these, as well as the way the men feel, will show any beneficial effects of the treatment.

The aluminum acts to check silicosis by coating the silica particles that are doing the damage in the lungs. This keeps the silica from dissolving and acting chemically to damage the lung. Studies by a number of investigators previously showed that it was not the sharp dust particles that damaged the lungs but some chemical reaction between free silica and the lung tissue.

Following this lead, Dr. Irwin and associates first tried the effect of aluminum in reducing the solubility and chemical reactivity of silica. Finding that aluminum could check both these actions, they tried aluminum dusting the lungs of laboratory animals with silicosis. The results showed that while lung damage was not changed, the potentially dangerous quartz in dust cells can be inactivated to a form in which the lungs can get rid of it. Success with treating the animals led to the trials now going on in the aluminum treatment of human silicosis sufferers.

"If our prognostication is correct, the usual inexorable progress of the disease will be arrested and functional impairment diminished," Dr. Irwin said.

Before treating human patients, a hundred men who had been exposed to aluminum dust in the course of their work for at least twenty-five years were carefully studied. These showed no sign of damage from the aluminum dust.

Preventing silicosis by aluminum dusting the lungs of men working in mines and other dusty trades has not yet been tried. The ideal way to prevent silicosis is to prevent the inhalation of silica dust by proper ventilation and other measures in the work places. The aluminum dusting method has been patented, and if it proves practical for both treatment and prevention, Dr. Irwin said, license to use it will be given only to plants that are up to standard on ventilation and other dust control measures.—JANE STAFFORD.

OKABAYATSIS COMET

DESPITE the German occupation of Denmark, the International Bureau of Astronomical Telegrams, at the Copenhagen Observatory, which is the world's clearing house for news of discoveries, seems still to be functioning. This is indicated by a cablegram received by the Harvard College Observatory, announcing the discovery in Japan of a new comet. It is signed with the name of Dr. E. Stroemgren, who has directed the bureau for a number of years.

News of the discovery was transmitted to Denmark by Dr. Hidewo Hirose, director of the Tokyo Observatory. The comet was discovered by a member of his staff, S. Okabayatsi, who is believed to be the same astronomer who discovered a new star in the constellation of Sagittarius in 1936.

Okabayatsi's comet is of the eleventh magnitude, it is too faint to be visible except with a telescope of at least moderate size. It is described as being diffuse, but with a central nucleus. Nothing is said about a tail.

It was found on Friday, October 4, at 1:49 P.M., by Eastern Standard Time, though, because Japan is on the other side of the International Date Line, it was still Thursday there. Its position, astronomically speaking, was 10 hours 7 minutes 31 seconds right ascension and 25 degrees 13 minutes 1 second north declination. This is in the constellation of Leo, the lion, north of the bright star Regulus, which rises in the east about 2:00 A.M. It was moving in a northeasterly direction, toward the next-door constellation of the little lion, and the Great Dipper, which is next beyond.

By October 10 the comet had already made its closest approach to the sun, and is becoming fainter as it recedes from the center of the solar system. Thus there is no hope of its being visible to the naked eye, since at the time of discovery it was of magnitude 11, too faint to be seen without a telescope. Calculation of its path has been made by Elizabeth L. Scott, at the University of California in Berkeley, showing that on August 11 the comet was nearest the sun, at a distance of about 90 million miles, slightly less than the average distance of the earth. A prediction based on this calculation shows that it will move into the constellation of the Great Bear early in November, passing alongside the pointers in the Great Dipper. It is heading almost directly north from its position at the time of its discovery in Leo, the lion.

The previous comets, since the beginning of September, were Whipple's periodic comet, found originally by Dr. Fred L. Whipple, of the Harvard College Observatory, and rediscovered on one of its seven-year visits on September 1 by his associate, Leland S. Cunningham. On

a photograph taken on September 5, Mr. Cunningham on September 15 found a comet which is expected to be seen easily with the naked eye this winter. Then, on the last day of September, Dr. Whipple discovered still another, on a photograph taken in August. Neither the old Whipple comet nor the new one will reach naked eye visibility.

A NEW PHOTOGRAPHIC FILM

(*Copyright, 1940, by Science Service*)

A NEW kind of photographic film, that wears longer in use, and stores better than the cellulose nitrate and cellulose acetate films now universally used, has been devised in the laboratories of E. I. du Pont de Nemours and Company, Wilmington, Del. This is shown by the posthumous issue of two U. S. Patents, numbers 2,216,735 and 2,216,736, to Dr. Wallace Hume Carothers, who died in April, 1937. The original patents for the du Pont synthetic fiber, nylon, were issued to him also. The new patents, like the old ones, are assigned to the du Pont Company.

The patent specifications point out that nitrocellulose is now most widely used for films, despite its inflammability, and that cellulose acetate, which has replaced it in some cases, has the disadvantage of low resistance to water, and poor strength and flexibility, especially when very dry. Fairly thick films must be used to compensate for the lack of strength. In color photography, where the picture may be coated on both sides of the film, and separated by its thickness, this causes a blurring of the picture.

Dr. Carothers found two groups of chemical substances which offer many advantages over the old material. One consists of linear superpolymers, and is covered in the first patent, the other includes linear polyamides. Both of these are crystalline, that is, they have a sharp melting point, and do not, like resins, gradually soften as the temperature is raised. In preparing the film, the material may be melted, and spread on a smooth, cool metal surface, or rolled between cool metal rolls, where it freezes into a thin sheet. These substances, it is said, have extreme strength, good flexibility and resistance to water, and are non-inflammable. On account of their strength, movie films made of them will last much longer when exposed to the wear of repeated passage through the projection machine. It is also possible to use films half as thick as ordinarily. This promises to be very useful in color photography. Layers can be coated on opposite sides of the film without causing a distorted image.

In other methods of color photography, several layers of emulsion are coated on a single film base. Using thin films of superpolymers or polyamides, each with its own emulsion, a three-deck sandwich or "tripack" can be built up, in which the total thickness is still surprisingly little, and the emulsions are very close together.

As an example of the advantage over older kinds of films, it is said that cellulose acetate film can be bent about twenty-five times before breaking, at 70 per cent. relative humidity, and about ten to fifteen times in a perfectly dry atmosphere. In contrast, at either degree of humidity, films made of one of the polyamides was intact after two hundred and fifty bendings.

According to the patent specifications, "This indifference to atmospheric conditions means that films of the present invention need not be stored under carefully adjusted conditions as is done with cellulose acetate. This unique property makes them specially advantageous as permanent business, library and historical records."

The advantages of the new film adapt them for cut or roll films, amateur or professional movies, microfilm recording of documents or publications, x-ray pictures, color photographs and sound recording.—JAMES STOKLEY.

ITEMS

SATISFACTORY observations of the total eclipse of the sun on October 1 were made by the expedition to Queenstown, South Africa, from the Cruft Laboratory of Harvard University. Though the party was mainly interested in radio studies, which did not depend on clear weather, it was planned to take photographs also, and, presumably, these were made. Two other American expeditions, to South America, were subjected to cloudy weather during the few minutes that the sun was covered, preventing such photographs.

THAT drought, which plagued large parts of the West during September, was completely broken during the first ten days of October, is indicated by reports to the U. S. Weather Bureau. In the Great Plains region and westward, water holes are full and usually dry streams are running. Moderate to substantial rains were wide-spread over most central and northern states, which had also been very dry during September. However, drought has taken a distressingly solid grip on the Southeast, where the soil is still much too dry for fall plowing, pastures, truck crops and winter grain seeding. Light showers relieved the situation somewhat in parts of the area, but were neither abundant nor wide-spread enough to do general good.

EPIDEMICS such as those that swept American army camps in 1917–18 can be largely obviated if we "make haste slowly" this time, mobilizing trainees gradually and in small groups and not trying to rush the process of physical hardening. This recommendation is offered editorially by the *Journal* of the American Medical Association. Dr. Hans Zinsser, the eminent Harvard bacteriologist who died only a few weeks ago, is cited by the *Journal* as authority for the opinion that the epidemics in the World War camps were due largely to the crowding together of large numbers of young men, some of whom were carriers of respiratory diseases, and to the efforts of the officers to harden their recruits up into real soldiers by too strenuous exercise and too prolonged drill.

BETTER results in operations for cataract are obtained by a new surgical stitching feat described by Dr. Luther C. Peter, of Philadelphia, at the meeting in Cleveland of the American Academy of Ophthalmology and Otolaryngology. Instead of waiting till the operation is finished to put in stitches, the surgeon takes a couple of what might be called "preventive stitches," somewhat in the manner in which a seamstress runs a thread around the space for a buttonhole before she cuts the hole.

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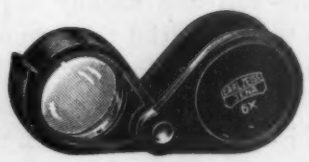

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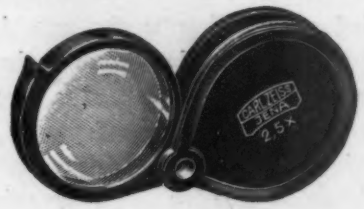

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SCIENCE NEWS

Science Service, Washington, D. C.

HYDROGEN PROMINENCES ON THE SUN

GREAT flame-like masses of gas, which sometimes shoot out from the surface of the sun to a height of a million miles, recently have been under scrutiny of astronomers at the Harvard Observatory, at Oak Ridge, Mass., with a new instrument.

Until now the most useful device for showing these prominences, which may be visible to the naked eye when the sun is totally eclipsed, is the spectro-helioscope, a fairly complicated device with a number of optical parts and a set of prisms rotated by a motor.

The new device, less than two feet in length, has been used as an attachment to one of the observatory's smaller telescopes. It was constructed by John W. Evans, of the Chabot Observatory, Oakland, Calif., who loaned it to the Harvard Observatory.

The reason prominences can not be seen ordinarily is because of the great glare of the atmosphere around the sun. The glare consists of white light, made up of all colors, while the light of the prominence is mainly one color, that of glowing hydrogen. Thus, to the eye, sensitive to all these colors, the total illumination from the sky drowns out the prominence. However, if some way can be found to pick up just the wave-length of hydrogen light, the prominence can be seen, for, with other wave-lengths excluded, it is much more brilliant than the sky.

This has been done with the spectroscope, but Mr. Evans used what is called a "quartz monochromator." This consists of a series of six crystals of quartz, each half the thickness of the preceding one. Between them are sandwiched layers of film which polarizes light, making it vibrate in one plane instead of many.

The spectrum of colors, which would be obtained by analyzing through a prism the light from the first quartz plate, would show a series of broad alternate bands of light and dark. Each successive plate widens the dark bands and squeezes the bright ones, until, after enough have been used, one of the bright bands is just wide enough to pass the hydrogen light. Colored filters cut out the others.

First suggested by a French astronomer, Dr. Bernard Lyot, the device was tried in Sweden by Dr. Yngve Ohman. However, he was not able to use as many quartz plates since he did not have the polarizing film available. Instead, he employed another method for obtaining polarized light, the Nicol prism. With one of these between each pair of quartz plates, the instrument was quite long.

Mr. Evans has also used the monochromator for photography, by the simple expedient of holding a camera at the eyepiece. For other than such experimental photographs, a more stable support would be used.—JAMES STOKLEY.

MEASUREMENT OF THE EXTENT OF STRETCH OF METALS

"SPEED laws," concerning the extent to which metals will stretch under heavy loads in machinery over a period of years, can now be determined in tests requiring from fifteen minutes to a few days. The testing machine used in these measurements was described at the New York meeting of the Society of Rheology by Dr. A. Nadai, consulting engineer of the Westinghouse Electric and Manufacturing Company's research laboratories at East Pittsburgh.

In building steam turbines, for instance, parts which are subjected to ten years of service at a temperature of 1,000 degrees Fahrenheit must not stretch more than a tenth of one per cent. during that time. Formerly, to test materials for these parts, three to six months were required.

"This new testing machine," explained Dr. Nadai, "will permit engineers quickly to assemble a vast library of intimate data on the creeping properties of a variety of steels and other metals and alloys, so that the designer may select the exact metal that will stand up under the service to be expected of it."

In a typical test with the device, a half-inch-diameter cast carbon-steel bar was subjected to a pull which was gradually increased to about six tons. All the time, an electric furnace around the specimen kept the temperature at 850 degrees Fahrenheit. In four minutes the bar stretched about a tenth of its length. With a pull of only four and one half tons, four days were required for the same stretch. Dr. Nadai finds that the difference in speed between the slow-moving turbine parts and the relatively rapid deformation of the steel plates in a rolling mill is about one quadrillion (1,000,000,000,000,000) to one. Since it is known that large rock masses in the outer layers of the earth's crust change shape by creeping, he suggested that these same laws may apply in geology as well.

A NEW METHOD OF STUDYING METALS

A NEW method of studying metals, with the microscope and x-ray in combination, that may yield useful information in connection with their use in guns, airplanes, engines and other defense needs, was described at the Cleveland meeting of the American Society of Metals by Dr. George L. Clark, of the University of Illinois, and Dr. William M. Shafer, of the Iowa State Teachers College.

Though x-rays are similar in nature to light waves, their waves are much shorter, and they can not be bent by lenses the way light can. Thus, no one has yet found a way to focus them, which would be necessary to magnify x-ray images directly. Instead, the method used is to take an x-ray picture, the same size, of a thin sliver of the metal being tested. Then, with light, a magnified photograph of the tiny x-ray negative is taken through a microscope. To get best results, it is essential to use a film with externally small grains, otherwise they would be magnified as well, and would mask details being studied in the metal. By using a special emulsion imported from Belgium, Drs. Clark and Shafer have found it possible

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In the new edition of this well-known book the author, besides bringing the material up to date, has expanded the text considerably to include the remarkable developments of the past eight years. The chapter on interpretation of X-ray diffraction patterns is entirely new, and new chapters have been added on the measurement of intensity, photochemistry, the biological effects of X-rays, etc.

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to magnify the finished result as much as 200 diameters, without losing detail.

Ordinary photographs of metallic specimens through the microscope are made of the surface, by light reflected from it. With the x-ray method a three-dimensional view is obtained, since the x-rays pass through the specimen. This shows better the internal irregularities of structure. Cracks and voids inside the piece are revealed. With the ordinary microscopic picture, the specimen must be carefully prepared and polished, but this is not necessary with the x-ray method.

Also, in some cases, it is stated, the usual treatment does not differentiate between different materials in the metal, but whenever the two materials have a different density, they are shown up by the x-rays.

THE KLYSTRON TUBE

WITH electrical waves as short as four inches in length, wireless power to light small electric lamps, has been transmitted at the Westinghouse Lamp Research Laboratories at Bloomfield, N. J., over a distance of many feet. Unlike the usual short waves used in radio, these can not penetrate non-metallic substances. They are stopped by a block of wood between the transmitter and the small antenna which picks up the energy to light the lamp.

I. M. Mouromtseff and G. M. Dinnick, as well as other Westinghouse engineers, have been working on the device, which is an intricate sort of vacuum tube, called the "klystron." It originated in the laboratories of Stanford University and is being developed in cooperation with the Sperry Gyroscope Company, designated by the university to promote its applications. The Westinghouse researches have greatly simplified it and reduced its size. Formerly, it required circulating water for cooling, but now it is air cooled.

Two doughnut-shaped copper tubes, called "rhumbatrons" because of the dance of the waves within their walls, are used to break up an electron stream, bunching the separate electrons, and converting their energy into high frequency waves, vibrating as much as 3,000,000,000 times a second. With the aid of a six-foot horn, these can be transmitted like a searchlight beam. When held in the beam, a small flashlight lamp, to which is connected a copper wire antenna, lights as if connected to a battery.

Electrical production of bodily heat for medical purposes and increasing the number of television channels as well as methods of transmitting more telephone messages over a single circuit are other possible applications of the klystron.

VITAMIN B

DR. NORMAN JOLLIFFE, of the New York University College of Medicine, speaking before the American Dietetic Association meeting in New York, stated that the average American consumes too little vitamin B for grade A health.

This vitamin, which has proved so complicated that it is now technically called the vitamin B complex, is known to contain at least twelve fractions. Five of the fractions are available in crystalline form for clinical use.

Lack of this vitamin, which occurs in such foods as milk and eggs, whole grains, liver and some other meats and fresh vegetables, is held responsible for a variety of ills, including some cases of neurasthenia, pellagra, an eye malady and a nervous disease which until recently was 100 per cent. fatal.

Dr. Jolliffe advised nutritionists to look out for vitamin B deficiency in diet of the following: Low income and poverty stricken groups; persons with bad dietary habits and food idiosyncracies; alcoholic addicts and patients with diseases which alter the requirements of this vitamin.

Vigorous use of nicotinic acid, one factor in vitamin B, has spectacularly reduced mortality from 100 per cent. to 15 per cent. in the nervous disease known as encephalopathy, which is now known to be caused by acute lack of this food factor.

While not all neurasthenia is caused by too little thiamin—another fraction of vitamin B—in diet, Dr. Jolliffe stated that lack of this vitamin plays a larger rôle in the nerve malady than is commonly believed. As common neurasthenic symptoms of too little thiamin, he cited poor appetite, fatigue, insomnia and often with them irritability, nausea, depression, constipation, headache, backache, "gas" and palpitations. Patients with paralysis agitans treated with still another part of the B vitamin, known as pyridoxin, have shown definite improvement.

NUTRITION AND DIET

FOR long life, better be thin than fat, is the lesson from latest experiments in which elderly white rats have gone through regimes of diet and taken running exercises in barrels, to shed light on the growing-old process.

Dr. C. M. McCay, professor of nutrition at Cornell University, reported to members of the American Dietetic Association studies with these animals which show that diet can retard the aging process and that types of diet may actually lengthen the life-line.

"It is evident," he said, "that nutrition workers have it within their power to learn much about the factors that govern the total span of life and about the diseases that attack us in our prime and later life. Factors such as the degree of body fatness and the calory intake are of great significance and should not be pushed entirely out of our thinking by the present stress upon vitamins, minerals and proteins." Describing his experiments, Dr. McCay said that some groups of rats have lived to be 900 days old, the equivalent of a 90-year lifetime in humans, and one rat passed the 1,400-day mark, putting it in the class with famous Thomas Parr, who claimed to be 152 years old when he died in 1653.

In tests recently completed, rats nearing "middle-age" have been started on routines in which some became fat and lazy on high calory diets and no exercise, while others became thin on low calory diets, with or without exercise. Rats forced to keep thin enjoyed significantly longer spans of life. If a rat became too thin or too fat, the life span was shortened.

By feeding rats a diet containing all needed substances for normal growth, but low in calories—the energy and fuel producing foods—Dr. McCay has shown that rats grow at a slow pace, and their life-line lengthens. This is significant as a method of postponing old-age diseases which terminate life. In tests now in progress, he has learned that at 500 days of age, only about one rat in

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ten on the retarded regime has diseases of the lungs and middle ears, while half of the rats following normal rat diet have these diseases.

The goal of such nutrition studies, he emphasized, is not to prolong extreme age "when one foot is in the grave," but to prolong the active period of productive effort in middle life and to alleviate the suffering of old age.

THE CURE OF CANCER AND SLOW NEUTRONS

(*Copyright, 1940, by Science Service*)

CURE of a certain type of cancer in mice by slow neutrons is announced by Dr. Paul A. Zahl, Dr. Franklin S. Cooper and Dr. John R. Dunning, of Memorial Hospital, the Haskins Laboratories and Columbia University, in a report to the National Academy of Sciences.

This appears to be an important step toward the better treatment of human cancer which physicists and physicians have hoped would come from the atom-smashing cyclotron in which the neutrons are produced.

Fast neutrons, like x-rays, can destroy cancer, but their usefulness in treatment is limited by the fact that they also destroy other living tissue. Slow neutrons, of the kind used in the spectacular splitting of the uranium atom, should be able to pass through the body with little or no damage to the tissues. When slow-neutron-capturing chemicals, such as boron or lithium, are injected in or around a cancer, the action of the neutrons on the capturing chemical should result in destruction of the cancer, while surrounding body tissues are unharmed.

Test-tube experiments with cancer tissue removed from the body showed that the boron-slow-neutron attack on cancer was five times as effective as a fast-neutron attack on cancer. This was reported by Dr. P. G. Kruger, of the University of Illinois. The mouse experiments now reported show the effectiveness of the slow-neutron-boron attack on cancer in living animals.

For any possible future use of this attack in treatment of cancer, it is believed that a better device than hypodermic injection should be developed for localizing either boron or lithium in the cancer tissue. Attaching lithium to large-particle colloidal dyes and injecting this into the veins is a promising improvement in the technic now being investigated.—JANE STAFFORD.

ITEMS

LIQUEFIED helium gas, at a temperature of about 460 degrees below zero Fahrenheit, the coldest substance in the world, has many peculiar properties. One newly discovered one was described by A. D. Misener, of the University of Toronto, at the Cleveland meeting of the American Society of Metals. If a channel through which an ordinary liquid is flowing is decreased in diameter, the speed of flow is lowered, but with this form of liquid helium it increases. He described a new theory of the distribution of the heat energy among the atoms of the liquid to explain this behavior.

CURRENT theories of the evolution of the huge spiral galaxies, star systems that look like pinwheels and are really similar to our own Milky Way but outside its limits, are questioned by Dr. Gunnar Randers, of Norway, who is now working at the Yerkes Observatory of the University of Chicago. In a paper to appear in the *Astrophysical Journal*, he says that there is no observational evidence for the idea now held that the "old" spirals are formed from "young" eliptical nebulae. "Many spirals suggest that the greater part of their material may be in the arms. If the arms were ejected from a system originally densely packed, the almost complete dissolution of that system would have been accomplished against the pull of the system's gravitational force." He suggests that "the nebular patterns are formed by the redistribution of the matter inside the originally 'smooth' nebula. This redistribution would take place early in the evolution of the nebula while it is still young and stars have not yet been formed from the gas of which it is composed."

IN a paper read before the Society of Motion Picture Engineers Dr. E. W. Kellogg, of the R.C.A. Research Laboratories in Camden, N. J., reported that sound reproduction in the movies is being made more realistic, with elimination of unwanted sounds, by keeping the sound track as dark as possible. The sound track, on the edge of the film, is a series of light and dark areas corresponding in intensity to the sound waves that recorded them. As the film runs through the projector, a light shines through the track, to a photoelectric cell, or electric eye. Light variations are converted into electrical variations, then back into sound through the loud speakers. Particles of dust and other foreign matter cause unwanted interruptions of the light, and this makes "ground noise" which spoils the perfection of the reproduction. The new system simply keeps the film track as dark as possible, so that if any foreign matter settles on it, there will be no effect. With loud noises, such as explosions or storm, the track becomes nearly clear, but then the objectionable sounds are drowned out.

PLANTS acquire immunity to disease, and in much the same way as animals do, is the conclusion reached by Dr. James M. Wallace, of the U. S. Department of Agriculture. Testing the destructive sugar-beet curly-top disease on tobacco, Dr. Wallace found that severely affected plants recovered, or at least showed very few evidences of the malady. At the same time, he discovered that there seemed to be developed by the plant an unnamed something which caused the disease to be held in check. The disease was still in the plants, Dr. Wallace explained, for healthy tobacco plants could be infected from the recovered ones. Dr. Wallace grafted healthy scions on diseased stocks, and diseased scions on healthy stocks, and found that the healthy portion became diseased, but mildly, depending on the length of time the disease-masking "something" had had to develop. "In short," says Dr. Wallace, "the phenomena are comparable to those known in animal diseases in cases of active immunization and the production of passive immunization by protective substances or antibodies. On the basis of the evidence obtained in these experiments, the behavior of the recovered plants is interpreted as acquired immunity and this acquired condition results from protective substances produced by a specific relation between the tobacco plants and the curly-top virus."

November 1, 1940

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SCIENCE NEWS

Science Service, Washington, D. C.

THE LARGEST KNOWN STAR

RAS ALGETHI, the brightest member of the constellation of Hercules, a group now seen in the western evening sky, is now pronounced the largest known star. It is 690,000,000 miles in diameter, about 800 times the sun's diameter of 864,000 miles.

This is shown by new calculations of George H. Herbig, of the University of California at Los Angeles. These demote from first to fourth place Antares, the red star in Scorpius, the scorpion, seen in the south on summer evenings. It has, for a number of years, been considered the largest.

First diameter measurements were made about twenty years ago at the Mount Wilson Observatory by the late Francis G. Pease, using a method originated by the late Dr. A. A. Michelson, of the University of Chicago. Using an instrument called the interferometer, he found the angular diameters of several bright, near-by stars. This is the angle between two straight lines from opposite edges of the star, meeting at the earth. In order to find the linear diameter, in miles, it is necessary to know the distance. A big star far away might have the same angular diameter as a small star much closer.

Using distance determinations then available, Antares seemed to be the largest of the stars measured, with a diameter of 430,000,000 miles. Since then, however, the accuracy of distance measures has been improved. Using these new values, furnished by Dr. Adrian van Maanen, of the Mount Wilson Observatory, Mr. Herbig has recalculated the diameters.

Ras Algethi, in the constellation of Hercules, a group now visible in the west in the early evening, proves to be largest, its diameter being 690,000,000 miles. It it were hollow there would be room inside to put the sun and the planets Mercury, Venus, Earth and Mars, all revolving in their present orbits, with Mars 178,000,000 miles from the surface.

Second in size is Mira, in Cetus, the whale, 395,000,000 miles in diameter. Third is Betelgeuse, in Orion, the warrior, now seen to the east in the late evenings. This seems to vary in size from 260,000,000 miles to 360,000,000 miles. Antares is fourth, with only 245,000,000 miles diameter. This, however, is still considerably larger than the earth's orbit, which is 186,000,000 miles in diameter.

THE ELECTRON MICROSCOPE AND TELEVISION

(Copyright, 1940, by Science Service)

THE electron microscope, now being made commercially in this country as well as in Europe, can be advantageously combined with television, according to U. S. Patent 2,219,113, granted to Martin Ploke, of Dresden, Germany. He has assigned his rights to the Zeiss Ikon Aktiengesellschaft, also of Dresden.

The size of the light waves themselves sets a lower limit to the dimensions of objects visible through an ordinary microscope. Electrons, behaving like waves of much smaller size, are used in the electron microscope to form the image, and they reveal smaller details. Though the electrons can not be focused with lenses, this is accomplished with coils of wire, setting up electrical and magnetic fields to bend the electron beams.

In his patent specifications, Mr. Ploke says that when the object to be examined is bombarded with electrons heat is produced, and that his invention avoids this. In one arrangement, he uses a beam of x-rays to throw a shadow of the object being examined on a thin metal foil closing one end of a vacuum tube. Where the x-rays fall, electrons are given off; these are focused, by electrical and magnetic means, on a sensitive television transmitting surface. The currents can be amplified many times, and the picture viewed on a television receiver.

Though the patent does not mention it, another advantage seems to be that the object under examination is in the open air, while in one form of electron microscope, now on the American market, the object must be in an evacuated chamber. Also, if desired, the television receiver could be some distance away, with a wire, or even a radio connection, to the microscope proper.

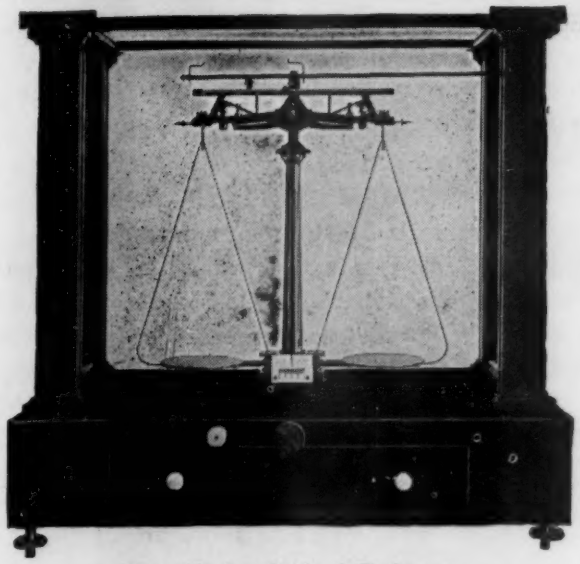
X-rays, being of much shorter wave length than light rays, reveal details as well as the electrons. For use where such extreme magnifications, of 20,000 diameters or more, are not desired, Mr. Ploke also describes a device that uses ultra-violet waves, shorter than visible light, though not as short as x-rays. These form an image of the object on a window at one end of the tube, electrons are given off where the rays fall, these are focused on a fluorescent screen at the other end, where they are changed to light, and the magnified image is clearly seen.—JAMES STOKLEY.

AUSTRALIAN Q FEVER

(Copyright, 1940, by Science Service)

THE National Institute of Health of the U. S. Public Health Service reports the first proved epidemic in the United States of Q fever. The epidemic attacked fifteen members of the staff of the institute, one of whom died. The only other proved case of Q fever reported in the United States was an accidental laboratory infection picked up during investigations of a new kind of germ found in ticks at Hamilton, Mont., at the Rocky Mountain Spotted Fever Laboratory of the U. S. Public Health Service. The germ was found on investigation to be the rickettsia which causes Q fever in Australia.

This same germ was the cause of the epidemic at the National Institute of Health this year. The National Institute report does not say, because it has not yet been proved, that this rickettsia is also the germ that has been causing cases of a new, atypical pneumonia that has appeared in the United States within the past few years. These pneumonia patients, however, had symptoms simi-



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lar to those of the Q fever patients. Examination after death showed changes apparently identical with those reported in the lungs at post-mortem examination of the atypical pneumonia victims.

Q fever and the atypical pneumonia are both mild ailments, not often fatal, and without x-ray examination of the patient's chest, either disease might readily be called influenza, rather than pneumonia. Neither, of course, is the same as influenza A, which is caused by a known virus. Patients with Q fever with an atypical pneumonia have fever, rarely any chills, frequently profuse sweating. They feel ill and exhausted, but do not have the breathing difficulty of typical pneumonia nor as severe body aches and pains as influenza.

"A comparison of the clinical features and physical findings in these cases," the National Institute's report concludes, "with various series reported from other sections of the United States in the past few years reveals suggestive similarities."

Q fever germs are kept at the National Institute of Health, but none of the persons handling these germs became ill. The fifteen patients in the epidemic were working in scattered places throughout the building with no known contact with these germs.—JANE STAFFORD.

UNSUSPECTED HEART DISEASE

THAT civilian and military pilots and the young men about to train for the defense service should have the benefit of a new and highly efficient triple test for unsuspected heart disease, was reported at the Memphis meeting of the Aero Medical Association by Dr. Walter Merritt Bartlett, of Benton Harbor, Mich., and Dr. J. Bailey Carter, of Chicago. They stated, on the basis of their experience with the test in more than 500 patients and routine examinations of 200 civilian pilots, that use of the test detects 20 per cent. more cases of heart disease than would be found by the usual physical examination.

Recent deaths of two young pilots, who suffered heart attacks in mid-flight and were barely able to land their planes before dying, emphasizes the need of more thorough examination of the pilot's heart. The ages of these two victims of unsuspected heart disease, 27 years and 34 years, respectively, show that serious heart disease is not confined to middle and old age.

"We, as examiners of pilots," Dr. Bartlett stated, "should place more emphasis on the thoroughness of our cardiovascular examinations. We are often chided about our rigid eye examinations that require pilots to be able 'to see around corners.' It is much more important that the pilot should live to see the next landing field. We must recognize that we are training men who must be able to stand the heavy pressure of flight duty. We can not expect such endurance in the presence of cardiovascular disease."

The new three-way test of heart fitness advised by Dr. Bartlett and Dr. Carter involves the use of the familiar electrocardiograms and of two new technics, stethography and cardioscopy. Electrocardiograms are records in the form of wavy lines on paper of the electric currents accompanying heart activity. With cardioscopy, the physician does not have to wait for a record on paper of heart activity, but can look at the message from the heart as it is being sent. If he sees signs of heart damage, he can have a permanent record made of it. With stethography, the heart "speaks for itself," giving a sound track record of its condition. Sound waves made by the heart as it beats are thus recorded so that the physician can tell whether the heart tones are normal or whether there are murmurs indicating heart damage.

Synchronized electric and sound wave messages give much more information about the heart's condition than either one alone. The sound record was essential for diagnosis of one fifth of the cases reported, detecting early heart disease that would not have been discovered in otherwise thorough heart examinations.—JANE STAFFORD.

ITEMS

AMATEUR photographers who wish to make correct exposures will be interested in a new light meter described at the meeting in Hollywood of the Society of Motion Picture Engineers by Captain Don Norwood, retired U. S. Army officer. Negative exposure control can now be put on the basis of an exact science. The meter measures the direct light, at the source, rather than that reflected from the subject, and its calibrations show how to set the lens. Reflectance problems occasioned by different tones, colors and shades are compensated for automatically, while effects of contrast, haze, color, etc., which are factors ordinarily inviting errors, are eliminated.

THE results of operations to restore hearing to the deafened are unpredictable, according to Dr. Samuel J. Kopetzky, of New York Polyclinic Medical School and Hospital, who reviewed the results of such operations performed by himself and others at the Chicago meeting of the American College of Surgeons. No cure of deafness can be promised to any patient from such operations, although a number of patients have had their hearing restored by operation. The reason why the operation succeeds in one case and fails in another can not be completely explained at present. Dr. Kopetzky is now trying, by what he calls "sampling," to determine the least amount of surgery that will restore hearing.

THAT proper balance of the amounts of the metals alloyed with iron in making stainless steel was found necessary to give the best corrosion resistance combined with good workability, was reported at the Cleveland meeting of the American Society for Metals. The research was carried out by Russell Franks, W. O. Binder and C. R. Bishop, of the Union Carbide and Carbon Research Laboratories. These types of stainless steel consist of iron with the addition of chromium, nickel and molybdenum. The best properties were found with the following percentages of these elements: 18–19 per cent. chromium; 12–14 per cent. nickel; 1.5–2.25 per cent. molybdenum, and not more than a tenth of a per cent. of carbon. By adding columbium, a somewhat rarer metal, still further improvement was obtained.

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SCIENCE NEWS

Science Service, Washington, D. C.

SYNTHETIC PHENOL

SYNTHETIC phenol, needed in manufacture of plastics and of some explosives, can now be made in large quantities from air and two common chemicals, benzene and hydrochloric acid, in a new plant at North Tonawanda, N. Y. It assures American manufacturers of an independent and controlled source of the important compound.

Built in the past two years, costing more than $2,000,000, the plant is housed in several large buildings, with towers and distillation units connected by forty miles of pipe. Three miles of the piping is made of glass, porcelain or rubber, to withstand the corrosive action of hot acids. Its capacity is 15,000,000 pounds of phenol per year. Yet the most modern control methods are employed, so only six men and a supervisor are required for its operation.

The new plant is part of Durez Plastics and Chemicals, Inc. It uses the so-called Raschig process of phenol manufacture, invented in 1930 by Dr. W. Prahl and Dr. William Mathes, of the Raschig G. m. b. H., Ludwigshafen a/Rh., Germany. The Durez firm owns exclusive United States rights to the process.

Though quite complicated, the Raschig process has two important advantages over older methods for the preparation of phenol, which is another name for carbolic acid. Its product is of high purity, greater even than that approved for medical use. Unlike older methods, which yield at least several pounds of by-product for each pound of phenol, this gives less than a tenth of a pound of by-product for each pound of the desired chemical.

The process has two main stages. In the first, a vapor mixture of benzene, hydrochloric acid and air is converted to mono-chlor-benzene. In the second stage this is mixed with steam which is converted into phenol and hydrochloric acid. The latter can then be used over again with a new batch of benzene. Also, the catalysts, materials which themselves are not changed, but which make certain of the reactions possible, are used many times.

In 1921, only 2,000,000 pounds of synthetic resins were produced, compared with more than 200,000,000 pounds last year. Those made from phenol have had the fastest growth, and were the first to be made on a mass production basis. Cameras, radios, brake linings, binders for plywood, telephones, paints and adding machines are a few of the common articles now made from them.

THE ELECTRIC POWER OF PASSENGER AIPLANES

AT the National Aircraft Production Meeting of the Society of Automotive Engineers P. Sandretto, superintendent of the Communications Laboratory of United Airlines, stated that fifteen kilowatts of electrical power, as much as required for a row of small houses, is used in the modern passenger airplane. Planes of the future, weighing 50 tons, carrying 100 passengers and a crew of 7, will take twice as much.

Lacking suitable magnetos, Mr. Sandretto said, early planes used storage batteries for ignition. This is no longer done, but other demands have raised power requirements from 2 kilowatts, in 1929, to 15 at present in the Douglas DC–3, the most popular transport plane now in use. Only 7.2 per cent. is actually used for operating the ship; 73 per cent. is for navigation, including radio, de-icers, etc., and the rest for service, mainly lighting for the passengers. Two generators, attached to the engines, provide the current, at 12 volts, which is used to charge storage batteries. In the future 100-passenger plane he predicted that there will be four engines, and each will drive a 7.5 kilowatt generator delivering alternating current at 115 volts. This permits much simpler control than with lower voltage direct current, but it can be converted to 24 volts, direct current, for charging batteries and for actual use.

In a paper presented on "Auxiliary Power Equipment," C. C. Shangraw, of Eclipse Aviation, agreed that "further consideration will be given to alternating current systems on larger aircraft being laid out for the future. Airplanes which are now under construction do not justify further consideration of this system."

For the immediate future, he suggested, "there is a definite trend towards the use of high-output engine-driven generators in 24-volt direct current systems. Auxiliary power plants are available which will operate in parallel with the engine-driven generators to supplement them or to furnish the required power for ground operation."

AIRPLANES AND MASS PRODUCTION

AIRPLANES can not now be made with the mass production methods used for automobiles, according to Paul G. Zimmermann, of the Douglas Aircraft Company, who spoke recently at Los Angeles before the National Aircraft Production Meeting of the Society of Automotive Engineers. However, he expressed the belief that a modified assembly line, such as he has previously employed in yacht building, might be applied to advantage.

"It is difficult to think of the airplane as a manufactured product," he said; "more reasonably it may be thought of as being built in the same sense as the large printing presses or hydro-presses.

"An order of five hundred bombers is really a very large order from a dollars and cents standpoint, representing a sale of around fifty millions of dollars. Of the fifteen thousand odd parts which go to make such a bomber, there are many where the requirements are for but one per ship, and still more for ten or less per ship.

"An order of five hundred parts, or even five thousand, can hardly be thought of as mass production, and yet these quantities of individual parts must be taken into consideration in the building of our order for five hundred airplanes. No one would think of rearranging a shop to make five thousand detail parts.

"This order of five hundred airplanes will start in all

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By **T. B. BROWN**, *Professor of Physics, The George Washington University*

For students in all fields of learning this book makes possible an acquaintance with the fundamental discoveries of modern physics, together with some understanding of the theories whereby these discoveries are developed and interpreted. Technical terms and phraseology have been avoided except where such terms may be fully explained, and only elementary mathematics is used.

Published September, 1940; 333 pages; 6 by 9; $3.25

LABORATORY OUTLINES AND NOTEBOOK FOR ORGANIC CHEMISTRY

By **CECIL E. BOORD**, *Professor of Organic Chemistry, Ohio State University;* **WALLACE R. BRODE**, *Professor of Organic Chemistry, Ohio State University;* and **ROY G. BOSSERT**, *Assistant Professor of Chemistry, Ohio Wesleyan University*

A guide for laboratory work to accompany the usual lecture course in organic chemistry given to chemistry majors. The scope of the experiments is ample: They are sufficient for a full-year course, although they may be adapted easily to shorter courses. They are arranged to correspond to the usual textbook order.

Ready November, 1940; 241 pages; 8½ by 11; $1.75

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good faith as being a firm order for five hundred exact duplicates of the original sample, but either the customer or the engineering department will think up some change which must be put into effect after the first hundred. Then another change will take effect on the one hundred and fiftieth, and the two hundredth, and so on through the building of the five hundred. Every one knows this condition exists, and in deciding any program either takes it into consideration or suffers a tremendous loss in scrap. The changes must be put into effect or progress will not be made.

"A few added miles to the top speed, or a few extra pounds added to the pay load, is so essential to airplane efficiency that no one can criticize the engineering department for making these changes.

"Right here we must come to a full realization that airplanes wouldn't be what they are to-day if the engineering departments did not have this freedom of action; they probably wouldn't cost so much either!"

A modified assembly line might be used, according to Mr. Zimmermann, similar to the scheme used successfully in building yachts, with the result of "labor costs being reduced 40 per cent. over the hit and miss production previously employed." With such a line, he said, "the less work done on the airplane proper the more easily the line can be speeded up. In yacht building, I was able to rig up a jig by which all the bulkheads were put on at one time, an overhead crane being used to drop them in place. Likewise the cabin top, with all assemblies installed, including windows, light fixtures and even curtain rods, was put on in one operation."

Careful erection lists, each one of which represents an assembly "which may be put together on the bench and assembled on the airplane as a unit," are needed to carry this out successfully.

THE STANDARDIZATION OF AIRPLANE PARTS

GREATER standardization of parts going into airplanes, particularly agreement between the Army and Navy for their respective orders, and exchange among aviation manufacturers of certain processing tools and engineering information, was urged as a means of speeding the production of planes for United States defense. These recommendations were contained in a paper presented at Los Angeles by John T. Thompson, standards engineer of the Glenn L. Martin Company.

"Since the Army and Navy each maintain separate aircraft design and experimental divisions and since the conditions of operation are somewhat different in these two services, it is quite understandable that a difference in opinion regarding the standardization of certain parts should exist," he said. "However, from the point of view of the manufacturer building aircraft for both services, it has been difficult to understand the reason for the inability of the Army and Navy to reach an agreement for standardization in the cases of many important items. Since the origination of the Permanent Working Committee of the Aeronautical Board, this situation appears to be improving; but there are still many delicate subjects to be attacked by this committee, and it will be interesting to observe the action which will be taken in regard to these items."

Mr. Thompson stated that a pool had recently been established among manufacturers of the dies used in making certain metal parts widely used in plane manufacture, and that this should be extended to other tools and equipment. Two other recommendations made were:

"To provide means for the cooperative establishment of new aircraft standard parts which will supplement the Army-Navy Standards for use on both service and commercial aircraft and which should result in a reduction in prices and an improvement in deliveries for parts heretofore standardized only by individual companies.

"To provide means for the exchange of certain unrestricted engineering information (such as test reports, research data, etc.). Such information, originally obtainable at considerable cost, and through years of experience, is usually traded for information of corresponding value thus eliminating the necessity for duplication in this work."

A NEW INSECT POISON

CHINA may furnish this country with new ammunition for defense against insect hordes that devour our crops, in a plant known as the Thunder God Vine, a botanical second cousin of the bright-berried bittersweet now flaunting its orange fruits along miles of autumn roadsides.

The insect-poisoning substance is found in the bark of its roots, and is used to a considerable extent in powder form by farmers in the interior of China. Its chemical nature, still unknown, is being intensively investigated by the U. S. Department of Agriculture in the hope that it may become possible to produce it synthetically, relieving the United States from the uncertainties of supply of the natural material from the war-clouded Orient. At the department's plant introduction garden at Glenn Dale, Md., thousands of cuttings sent from interior China by a plant explorer are now being grown, to furnish more material for experimental purposes.

Preliminary experiments are regarded as promising. Powder prepared from the vine roots proved effective against the codling moth, most destructive apple pest in this country, and against two species of cabbage-eating caterpillars. However, until many further tests are made the material will not be recommended for commercial use. Cuttings are not available for distribution at present.

In actual growth habit, the Chinese Thunder God Vine is not really a vine, but a sprawling bush that grows three or four feet high, with long, drooping branches that trail on the ground, like some species of raspberries and wild blackberries. Although related to the common American bittersweet, its fruits are not so bright-colored and ornamental. Botanists identify it by the technical name *Tripterygium wilfordii*.

THE FOLSOM MAN

EVEN Ice Age America, back in the days of a mammoth and bison hunter "population," had its economic ups and downs. This is the latest revelation of this country's past, unearthed in Colorado by Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution.

Finding a stratified corner at the now-famous Lindenmeier site, a camp and workshop occupied by Folsom Man in the Ice Age, Dr. Roberts has charted about 1,000 years of very early American prehistory. The story, told in gradually accumulated layers of earth, each containing a typical kind of stone weapon point, reveals Folsom Man as first and oldest at this convenient camping ground. Folsom hunters arrived some time between 10,000 and 25,000 years ago, and more likely it was 25,000, Dr. Roberts infers from the geologic evidence.

Following bison herds through rich pastures south of the retreating ice sheet, Folsom hunters returned to this camp many summers. Their weapons were the beautifully shaped and grooved Folsom dart points, and they had time for careful work, an eye for beauty—judging by simple efforts to decorate belongings—and they even sewed their garments with eyed needles. Folsom Man's —or Woman's—needles are pronounced by Dr. Roberts evidence that early America used true needles when they were a sign of progress also in cave homes of Europe.

Harder times or more uncouth people followed within a few centuries, judging by the next distinct layer of earth above, containing a degenerated sort of Folsom weapon, hastily made. If the new arrivals were not Folsom descendants, they did at any rate have some of the advantages of Folsom culture. Before they came, the camp had lain abandoned and blanketed with débris. The newcomers made brief stays only at the camp, and it looks as though they lacked the comparative ease of "better times" in America. The campsite eventually lay vacant again, until a third wave of hunters arrived, leaving a quite different dart point.

The stratified find establishes the sequence of early Americans using these strange old weapons, and will aid archeologists in judging the relative age of such weapons found in other parts of western United States.

Dr. Roberts believes that still another type of Folsom weapon, which has been found scattered in eastern states, represents a still later chapter of this little-known era of American prehistory.

THE CUNNINGHAM COMET

CONCLUSIVE evidence that the new comet discovered recently by Leland S. Cunningham, of the Harvard College Observatory, will be the most conspicuous since 1910 is contained in his latest calculations of its path. These have been made public by Dr. Harlow Shapley, director of the Harvard Observatory.

They show that in early January, the comet will be easily visible in the western sky for an hour or two after sunset, as it passes south of the bright star Altair in the constellation of Aquila, the eagle. At that time, it will be about as bright as Altair, and possibly even more brilliant, though it is somewhat uncertain just what brilliance it may attain.

Its distance from the earth, at the beginning of 1941, will be about 60,000,000 miles, and from the sun about 50,000,000 miles. It will be at its closest to the earth about January 10, when some 54,000,000 miles away, and to the sun, with 33,000,000 miles, on January 16. Between these dates it will be the most brilliant. However, it will then be so close to the sun as to be seen, if at all, only in the evening twilight. Consequently, it will not be as conspicuous as earlier, when it has a dark background. In the closing days of December, the moon, in a crescent phase, will pass to the left of the comet.

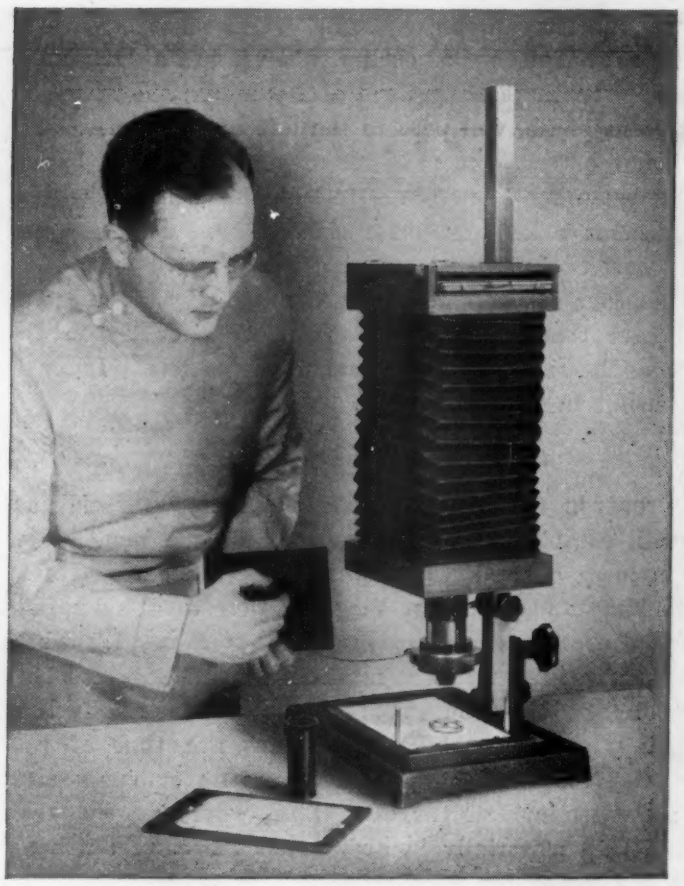
Though several comets in recent years were just barely visible when one knew where to look this will be the first conspicuous naked-eye comet since 1910. In that year there were two: Halley's, making one of its 75-year visits, and another which appeared earlier in the year, and was so bright that it was discovered independently in the southern hemisphere by a number of persons. Later it was visible in North America.

ITEMS

OCTOBER'S final week upheld the record for unusual warmth established during the rest of the month over the country generally. Only in the northeastern states, from Maryland and West Virginia, were there subnormal temperatures for the season, and real freezes. Elsewhere temperatures ran up to as much as 8 to 20 degrees above normal for the period. Large areas that normally have freezing weather or killing frosts at this time of year are still frost-free. This has proved an embarrassment in some sections of the Corn Belt, where a good frost would help materially in drying out the ears, which are still too moist for safe cribbing. Elsewhere, however, corn picking goes on apace, and the soybean harvest is also making rapid progress. Cotton is practically all in, over the Texas area, and is being rapidly finished in Oklahoma.

A SPECIES of soil bacteria discovered on the campus of the University of Wisconsin is proving useful in the development of industry in Puerto Rico. It is a germ that has high capacity to convert molasses into butyl alcohol, much in demand as a commercial solvent, especially in the paint industry. The organism was discovered by Professor Elizabeth McCoy, of the university, and named *Clostridium Madisonii* for the place of its discovery. One of the severe problems of butyl alcohol production in Puerto Rico has been a germ-killing virus or bacteriophage that seriously reduced production. The difficulty was solved by developing a strain of the new bacterium that is resistant to the virus.

THE healing of cancers by treatment with fast neutron rays from the cyclotron given to forty-seven cancer patients who were too far advanced to be helped by x-rays, radium or surgery, has been reported by Dr. Robert S. Stone and Dr. John C. Larkin, of the University of California. The cancers themselves, both primary and those that had spread from the original one to other parts of the body, regressed. The primary cancers that ulcerated under the treatment "healed remarkably well." Whether or not the patients can be considered cured or whether the cancer will come back can not be told yet, as it is only two years since the first patients in the group began treatment. Better results are predicted when the method of giving the treatment can be improved. Normal tissues are apparently not damaged irreparably by the doses of fast neutron rays necessary to produce regression of the tumors.



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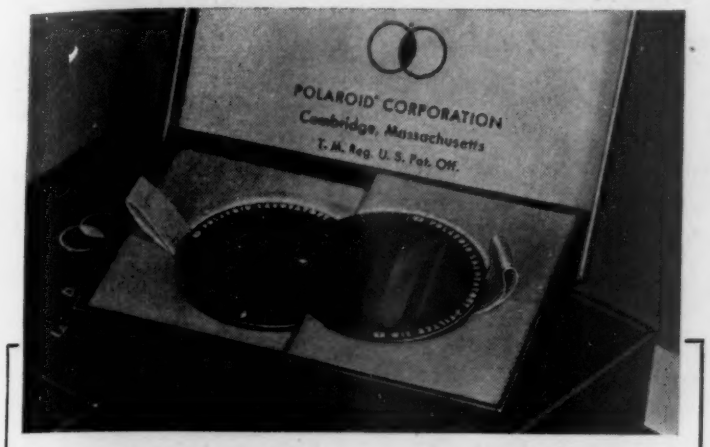

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SCIENCE NEWS

Science Service, Washington, D. C.

COLLAPSE OF THE TACOMA NARROWS SUSPENSION BRIDGE

COLLAPSE of the four-month-old Tacoma Narrows Brigde in a high wind seems to be different from past failures of suspension bridges. Generally, it has been the great cable that hangs in a graceful catenary from pier to pier that has given way, but the Tacoma cables apparently remained intact. Evidently the breaks which let the roadway fall into the stream occurred at the lower ends of the vertical cables, supporting the road.

No alarm need be felt for a suspension bridge which sways in the wind, for they are supposed to do that. However, the sway should not be so great as to make users seasick, as the Tacoma Bridge, nicknamed "Galloping Gertie," is said to have done.

There have been several cable failures in bridges, two of which, the Mount Hope Bridge near Providence, R. I., and the Ambassador Bridge at Detroit, were discovered in time, during construction, and before an actual collapse. When it was found that the cables were beginning to break, they were removed, and new cables were strung in their place. Other failures of cables were the International Bridge near Laredo, Texas, and the General Grant Bridge across the Ohio River at Portsmouth. In each case, the bridge was restrung with new wire.

The oldest large suspension bridge still in use is the one which carries a roadway for a span of 580 feet across the Menai Strait in north Wales. This was built in 1819–1826, and uses wrought iron links for the suspension. The Brooklyn Bridge, completed in 1883 with a center span of 1,595 feet, was the first large bridge to use cables of stranded wire.

The largest suspension bridge is the one crossing the Golden Gate at San Francisco, with a span of 4,200 feet. George Washington Bridge over the Hudson River at New York is second, with 3,500 feet. The Tacoma Bridge, of 2,800 feet span, was third; while the San Francisco-Oakland Bridge, with two 2,310-foot spans, ranks fourth. The behavior of these others, under all conditions, makes engineers feel sure of their safety.

Though the Tacoma Bridge was partly financed by the PWA, which is making an investigation, no announcement thus far has been made. The chief of engineers of the U. S. Army had to approve the bridge before it was built, as they do with all those crossing navigable streams. This, however, is not concerned with the design or construction, but merely with horizontal and vertical clearances, to make sure that there will be no obstruction to navigation.

NEBULIUM AND CORONIUM IN THE SUN AND NEBULAE

AFTER years of study, astronomers seem now close to solving the problem of the identity of nebulium and coronium, "mystery elements" found in the distant nebulae and in the sun's corona, which is visible best at eclipse time.

According to a paper by a British astronomer, Clifford G. James, in the annual report of the Smithsonian Institution, just issued, the former seems to be merely ordinary oxygen in disguise. The latter may be oxygen also, though this is not yet certain.

Each of the 92 known chemical elements, when its vapor is made to glow, gives off a characteristic kind of light. This can be identified by the lines which appear when this light is analyzed through the prisms of a spectroscope. Thus it is possible to tell the elements that exist in the distant stars and in the sun.

In 1868, Sir Norman Lockyer found a line in the light of the sun which could not be identified with any earthly element, so he called it helium. Later it was found on earth, as a light gas.

Four years before Lockyer's discovery, another English astronomer, Sir William Huggins, had found a strange green line in light from the distant nebulae in the sky. This was ascribed to a hypothetical element called "nebulium." Similarly, when in 1869 Charles A. Young, then of Dartmouth College, found a mysterious line, also green, in the sun's corona, this was credited to another element, "coronium."

"In many cases," says Mr. James, "speculation overrode sound scientific method and it was suggested by good authorities that this celestial radiance might be due to primeval world stuff, the cosmic protoplasmic fluid from which the world had been manufactured in the beginning. As new elements were discovered their spectra lines were matched with those of nebulium, but to no purpose. None was found to coincide. It gradually came to be accepted that the hypothetical nebulium was some familiar gas clothed in an unfamiliar fashion."

Explanation of nebulium came when Dr. I. S. Bowen, of the California Institute of Technology, showed that it is probably merely oxygen atoms excited to an abnormal state. The enormous energy required for this excitation seems to come from very hot stars, at temperatures up to 200,000 degrees Fahrenheit, associated with the nebulae. Under these conditions shifts of electrons in the oxygen atoms, which are "forbidden" on earth, can occur and these shifts give out the strange kind of light.

There is still some uncertainty about coronium, according to Mr. James, but, "it is possible that it may be diffuse oxygen in an unfamiliar ionized state."

NEW FABRICS MADE IN GERMANY

FABRICS made from a synthetic resin, polyvinyl chloride, are considered in Germany a great advance over rayon, Lanital and other materials derived originally from plant and animal sources. An enthusiastic description of the new fiber, written by Dr. Herbert Rein, is printed in a July number of the *Die Umschau.*

A chemically related product of American origin is already on the market in this country, under the trade name of Vinyon. The polyvinyl chloride fiber is given

the convenience-name "PeCe" (pronounced "pay-say"). It is derived from coal, lime, water and chlorine. The coal and lime are combined in the electric arc to form calcium carbide. This in turn is united with water to make acetylene. The acetylene, with the addition of chlorine, becomes vinyl chloride. Vinyl chloride molecules are linked together (polymerized) to form polyvinyl chloride.

Up to this point the process is not unlike that followed in American chemical plants to make the transparent plastics used in such things as the "sandwich" layer in safety glass, stretchable belts and suspenders, and similar products. It is also somewhat akin to the making of the synthetic rubber, Neoprene.

However, the German manufacturers dissolve the plastic into a gummy mass and then spin it out into fine fibers, very much as rayon, nylon and other synthetic fibers are produced in this country. These are then spun into thread, to be woven into cloth, knit into hosiery, twisted into cordage or otherwise processed. Many advantages are claimed for the new fiber. It is highly resistant to both strong acids and strong alkalis, so that it can be used for safety-garments in chemical factories, as lines and handles where cotton or hemp are quickly corroded and destroyed, and as filters where ordinary cloth or paper do not stand up at all. It is fire-resistant to a certein extent: while it can be ignited, it is easily extinguished, and does not smolder afterwards. It is also resistant to decay through the action of molds and bacteria.

Nevertheless, it has some drawbacks, which probably would militate against its successful competition with such a fiber as nylon. PeCe is thermoplastic, that is, it softens and loses strength and shape when heated. For this reason, it can not be washed in really hot water and ironing, even with a moderate iron, is regarded as inadvisable. For the same reason, exposure to steam is injurious to PeCe fabrics and filters used for industrial purposes.

FOSSIL BIRDS

A SINGLE fossil jawbone of a long-extinct big bird, found recently in Alberta by Dr. Raymond M. Sternberg, of Hayes, Kansas, becomes the basis of an entirely new order of birds, the Caenagnathiformes, in a technical revision of the birds of the world just published by Dr. Alexander Wetmore, assistant secretary of the Smithsonian Institution. It is placed just below the ostriches in the classification table.

The fossil came out of a bed of dinosaur bones and is itself so primitive that it may be reptilian rather than a bird. However, Dr. Wetmore accepts it as such pending further information. The age of the deposit was Late Cretaceous, about 100 million years ago. Another fossil bird family, the Paranyrocidae, belonging to the general class of ducks, geese and swans, is included because of one curious fossil found in South Dakota deposits about 30 million years old.

Fossil records of birds are far less complete than those of reptiles and mammals. Vertebrate fossils are formed, as a rule, through the settling down of a dead body in the mud of a marsh, or through covering with volcanic ash during an eruption. This is far less likely to happen to birds than to the heavier-bodied ground-dwelling animals. Smaller birds especially, falling to the ground when they die, are usually either picked up by carrion-eaters or decay as they lie, even their delicate bones becoming shattered and scattered before they can become imbedded under conditions suitable for fossilization.

In Dr. Wetmore's revision, the birds of the world are divided into 34 orders, comprising 202 families.

VITAMIN B_1

DR. C. A. MILLS and Dr. J. W. Colvin, of the University of Cincinnati, reported at the recent meeting at Louisville, Ky., of the American Society of Tropical Medicine that the depressing effects of tropical heat can be overcome by doubling the daily intake of vitamin B_1, or thiamin. The laboratory findings will be tested on natives of Panama early next year. The authors stated that "Thiamin protection against the evil effects of excessive heat has further important bearings for temperate zone inhabitants during severe heat waves of summer, and for industrial workers who are exposed to the severe heat of boiler and furnace rooms or other conditions that render body heat loss very difficult. A thiamin intake double that ordinarily considered ample seems likely to offer a large measure of protection against such heat effects and also to offer a most effective therapeutic adjunct in the treatment of heat exhaustion states. Energetic people going from stimulating climates into tropical warmth would probably suffer less of a physical slump if they fortified their ordinary dietary thiamin intake with 2–5 milligrams of additional thiamin each day. A large part of dietary thiamin is found in the protein foods that are unconsciously avoided in warm climates because of their specific dynamic action in increasing body heat production."

The reason why thiamin could be expected to put pep into people living in tropical climates or soldiers fighting there is because of its rôle in the burning of sugar and starch in the body. Without this vitamin the oxidation or burning of glucose stops midway.

Combustion in the body, however, is necessarily lowered when tropical warmth makes it more difficult to keep cool by dissipating heat from the body. With this lowering of tissue combustion goes a fall in "all measurable indices of individual vitality—slower growth, retarded development, lessened fertility, lowered resistance to infection and ability to produce protective antibodies against pathogenic invaders, and in all ways a lowered existence level."

At the University of Kansas there is now in progress a study showing a lower order of cerebration in animals kept under conditions of moderate difficulty of heat loss—greater difficulty in mastering the intricacy of a maze and in performing other feats of animal learning.—JANE STAFFORD.

INFANTILE PARALYSIS

(Copyright, 1940, by Science Service)

ENCOURAGING results in efforts to create a new kind of protection against infantile paralysis were reported by Dr. Harold K. Faber and associates of the Stanford Uni-

versity School of Medicine, at the meeting in New York of the National Foundation for Infantile Paralysis.

The new kind of vaccination is aimed at protecting the central nervous system where the virus of the disease does its damage. Previous efforts at vaccination against infantile paralysis have failed, it is generally believed, because the vaccine reached the blood cells, but not the cells of the central nervous system where it was needed to combat the virus. Vaccines against other diseases succeed when they cause an increase in germ-fighting substances in the blood.

Dr. Faber and associates have been trying to produce immunity to infantile paralysis by applying killed infantile paralysis virus directly to the cells of the central nervous system.

Results to date offer encouragement, although the studies have not progressed far enough to allow an evaluation. Dr. Faber and associates have, however, been able to produce considerable penetration of the dye, Prussian blue, into the central nervous system, and it may be possible to use the same method for the vaccine.

Dr. Alfred E. Fischer, of the New York University School of Medicine, believes as a result of studies during the 1937 outbreak in and around Toronto that a child who has had his tonsils removed is in greater danger of getting infantile paralysis than one who has not had this operation. He is not only in greater danger of getting the disease but is more likely to get it in the form which may make him a candidate for an iron-lung existence. This is the bulbar type of infantile paralysis that attacks vital centers of the brain, such as those controlling breathing. The incidence of the bulbar type of the disease was twice as great in patients who had had their tonsils removed at any time during the past as compared with those whose tonsils were intact.—JANE STAFFORD.

ITEMS

CALIFORNIA is to have a winter slightly moister and a little cooler than the average of the preceding twenty-two seasons, according to the long-range indications worked out by Dr. George F. McEwen, of the Scripps Institution of Oceanography at La Jolla. The rainfall excess probably will be least in the south and will become progressively greater toward the north. Dr. McEwen has been working for many years on a system of indications for regional rainfall and temperature probabilities, based largely on ocean temperatures during the summer and autumn. His forecasts have proved essentially accurate in a high percentage of cases.

A WIND tunnel, like those used by aviation engineers, has been built at the California Forest and Range Experiment Station for the study of forest fire conditions. It is described in *The Journal of Forestry*, by Wallace L. Fons, of the station staff. No effort is made to attain the wind velocities commonly attained in the wind tunnels used in aviation research, for these hurricane air speeds have little significance in connection with forest fires. Velocities below 15 miles an hour have been found sufficient for all practical purposes. A number of other research problems in forestry, outside the field of fire investigation, have been suggested for further use of the tunnel. These include effect of ground cover on wind erosion, evaporation of moisture from soil surfaces, efficiency of various types of windbreaks, distribution of tree seeds, and migration of insect pests.

BOVINE tuberculosis is now practically eradicated throughout the United States, according to an announcement made by the U. S. Department of Agriculture. The last two counties, Kings and Merced, in the last state, California, have completed their testing and retesting for infected cattle, and now every county in every state in the Union has fewer than half of one per cent. of its cattle infected. The campaign has been going on for twenty-three years, in the course of which more than 232 million tuberculin tests and retests have been made, and about four million tuberculous cattle detected and removed for slaughter. This does not mean that nothing further remains to be done. Retesting is still called for, especially in herds from which tuberculous animals have been removed in recent years, to prevent reinfection and a new spread of the disease.

X-RAY slicing as an aid in diagnosing sinus disease as well as other ailments that can not be accurately detected by ordinary x-rays was presented by Dr. Sherwood Moore and Dr. Alfred J. Cone, of Washington University School of Medicine, St. Louis, at the Chicago meeting. By the x-ray slicing technic, scientifically known as body section radiography, pictures are taken of thin, successive layers of the sinuses or other parts of the body. In ordinary x-ray pictures, all structures capable of absorbing the rays cast their shadows on the film. As a result, the thing the doctor wants to see may be obscured or entirely hidden by these unwanted shadows of structures not important to diagnosis in a particular case. The x-ray slicing technic greatly aids diagnosis.

TESTS of loudspeakers in movie theatres, usually difficult because of standing waves set up by reflection from walls and ceiling, can be made more reliably with a new method, according to S. L. Reiches, of Cleveland. A generator producing a pure tone, to avoid the complications arising from harmonics, is used, and the measurements are made of the sound which comes from the horns in the split-second interval before the standing waves are formed. Readings are made on a meter which is graduated in decibels, the units of sound intensity.

"MILKING" rattlesnakes and cottonmouth moccasins is a profitable business—if you have the right kind of nerves and know the ways of your snakes. The snake-milking operations of a quick and cool-headed Floridian, Ross Allen, are described in the new issue of *Natural History*. Mr. Allen gets twenty cents for the product of an adult rattlesnake, about one teaspoonful. He can "milk" about 150 snakes in an hour, and once succeeded in cleaning up that number in 44½ minutes. All told, he has "milked" about 40,000 poisonous snakes without ever having been bitten. The venom is used in certain kinds of medical treatment, and in research.

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SCIENCE NEWS

Science Service, Washington, D. C.

COSMIC RAY MEASUREMENTS FROM LITTLE AMERICA

FIRST observations to determine the effect latitude has on a recently discovered characteristic of cosmic rays that bombard the earth from outer space will be made soon when the U.S.M.S. *North Star* sails from Seattle on a round trip to Little America to bring back the last of the United States Antarctic Expedition.

According to Dr. Serge A. Korff, of the Bartol Research Foundation of the Franklin Institute, Dana Bailey, of the Harvard College Observatory, will make the observations. These will be of the neutrons, electrically neutral particles, that are produced by the cosmic rays. Discovered in 1932, as produced in the laboratory, their connection with cosmic rays has only lately been noticed.

Dr. Korff has designed a new form of counter to measure them, as distinct from the measurements of the other types of cosmic radiation. This consists of a tube containing a gas, boron trifluoride. The neutrons break up the nuclei of the boron atoms, and alpha particles, atomic bullets of another kind, are formed. These are detected in the counter.

Mr. Bailey, whose studies at Oxford University as a Rhodes Scholar were interrupted last spring by the war, will sail from Seattle on December 1 and will be back about the end of April, 1941. He will also bring back two cosmic ray meters of the type devised by Dr. R. A. Millikan, which have been in use at Little America since January, 1940. These he will continue to operate on the return voyage.

Dr. Korff expressed the opinion that the year's work at Little America will yield important data on cosmic rays. The meters were installed by Dr. Eric Clarke, now of the Massachusetts Institute of Technology, and have been operated by Dr. F. Alton Wade, senior scienstist of the Antarctic Expedition. He took the meters on one flight over Antarctica, which reached an altitude of 22,000 feet.

From the results obtained, especially during the Antarctic night, it may be possible to learn whether cosmic ray fluctuations near the South Pole can be correlated with those here, and whether they have any relation to changes in the earth's magnetic field and magnetic storms.

On Commander Byrd's last expedition, cosmic ray meters were used, but these were of a less sensitive type than those now employed.

SUPER-SPEED EARTHQUAKE WAVES

THE present picture of conditions deep beneath the surface of the earth will need to be revised, according to Dr. L. Don Leet, director of Harvard's Seismograph Station. He has just completed new measurements of the speed at which earthquake waves travel underground and has found that some of them go about 1,500 miles an hour faster than experts had thought. The new figure, the highest ever recorded, can not be explained in terms of any familiar geological material or present theories about conditions of heat and pressure twenty-one miles below the earth's surface. Obviously, these new measurements indicate that the physical laws and conditions applying deep underground are still imperfectly known.

Dr. Leet made his clockings from the records of some fifty earthquakes which have visited New England and vicinity during the past six years as tabulated on the first good-sized network of seismograph stations to employ a new type of extremely sensitive quake-detector.

Special attention was paid to the waves traveling in the upper layer of the so-called mantle of the earth, about twenty-one miles underground, and Dr. Leet found that the "push" waves in this layer, that is, those which give a back-and-forth motion, scud along at 5.2 miles a second. The previously accepted velocity was 4.8 miles a second.

The instruments used in the study were Benioff seismographs, the most sensitive yet devised, which were developed by Professor Hugo Benioff, of the California Institute of Technology. Harvard has six of these quake-recorders and others are at the Dominion Observatory, Ottawa, Williams College, Weston College, Fordham and the Massachusetts Institute of Technology, all of which participated in the study.

The investigation involved the determination of the location and exact time of occurrence of the earthquake and of the time of the arrival of the various wave forms at these observing stations, from which data the speed of the waves could be derived.

The research also enabled Dr. Leet to map for the first time the surface layers of the earth in New England down to the mantle. The top layer, he found, is dominantly granitic and extends down about nine miles. Then comes a second layer of heavier minerals which is six miles thick and probably basaltic. A third layer, also about six miles thick, is of undetermined composition.

A RADIUM SUBSTITUTE

X-RAY photographs of parts of airplanes and other machines important for defense, to discover any hidden defects and now made with radium, may soon be made with an artificially produced radium substitute, radioactive yttrium, prepared in the laboratory by bombarding strontium with atomic bullets from a cyclotron.

Dr. Charles Pecher, Belgian physicist, now working in the William H. Crocker Radiation Laboratory of the University of California, announces the separation of this material in a communication to the last issue of the *Physical Review*.

Dr. Pecher was interested in making the element strontium radioactive for biological investigations. This was done by bombarding strontium samples with 16-million-volt deuterons from the cyclotron. Some of the strontium atoms are converted into a form of another element, yttrium, which also has properties like radium, and which lasts for about 100 days, much longer than most of the artificially radioactive substances. Already, he says, enough has been obtained to be equivalent to about 25 milligrams of radium.

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"Because of its long life and penetrating gamma-radiation," writes Dr. Pecher, "this radioactive yttrium is, among the artificial radioactive elements known at the present time, the most likely to be substituted for radium, but it must be considered at the present time merely as a by-product of the radio-strontium preparation as it is, as yet, appreciably more expensive than radium for a like dose of gamma-radiation."

HEALTH HAZARDS CAUSED BY WAR

INFLUENZA, measles and pneumonia will be the major health hazards to the English people under simultaneous siege from war and cold weather this winter, according to a prediction by Dr. John E. Gordon, director of the American Red Cross-Harvard Hospital shortly to be erected in southwest England.

Protection of America from the same war-borne health hazard, should war come to this country, is the objective of the studies Dr. Gordon and associates will make in a hospital of twenty-two buildings now being pre-fabricated for shipment abroad next month.

When epidemics strike a nation at war, doctors and health authorities are too busy trying to check the epidemic and care for the sick to have any time for investigating where and how the epidemic started and traveled. Such investigations, however, could give valuable information for prevention of wide-spread sickness and death in the future, Dr. Gordon explained.

To gather such information on the ground, for the benefit of the U. S. Army, Navy and Public Health Service, Dr. Gordon and some of his associates will study patients in the 100-bed hospital. At the same time, field units, consisting of two physicians and three nurses, will go out with laboratory trucks to investigate epidemics at the point of their outbreak, using the hospital and its laboratory animals as a base.

Each of the 22 buildings of the hospital will be an almost completely self-contained unit. This is partly to minimize damage in case of air attacks and partly to provide more complete isolation of patients suffering from different contagious diseases, such as measles, scarlet fever, influenza and the like. The latest shatter-proof and blackout-features and bomb shelters will be provided for all the units as protection against air raids.

Dr. Gordon is now organizing the staff of the hospital, which will consist of some 75 doctors, medical technologists and Red Cross nurses. They will leave for England about January 1. Dr. Paul B. Beeson, Boston specialist in chemical treatment of infections, will be physician-in-chief of the hospital. Dr. Gerald F. Houser, also of Boston, will be administrative superintendent. Miss Patience L. Clark, of Detroit, will be at the head of the staff of 50 Red Cross nurses. More than three applications have been received for each post available on the hospital staff, Dr. Gordon said. Physicians, nurses, medical technicians, ambulance drivers from all over the nation have sought appointment.

COLOR MOVIES OF DISEASE IN CIRCULATING BLOOD

NEW aid to national defense on the medical side may come from color movies shown at the Southern Medical Association meeting at Louisville, Ky. They are the first motion pictures ever taken of disease in the circulating blood of a living animal.

The disease is malaria, the old "chills and fever" which scourged American troops during the Spanish American War. With the supply of quinine, chief anti-malaria chemical, threatened by present war conditions, medical authorities planning for national defense have been worrying over the problem of protecting American troops from malaria if they should be sent to Central or South American tropics on hemisphere defense duty.

The color movies were taken by Dr. Melvin H. Knisely, of the University of Chicago, now working at the University of Tennessee, Dr. Warren K. Stratman-Thomas, malaria expert of the Tennessee Valley Authority, and Dr. Theodore S. Eliot, associate professor of histology at the University of Tennessee. They show that malaria kills by turning the fluid blood into a thick sludge which plugs up the tiny arteries and veins. Then, contrary to popular conception, the heart is literally worked to death trying futilely to push more blood against the blockade of this malarial sludge in the veins and arteries.

As the disease progresses, the color movies show, the power of the blood's scavenger cells to engulf the clumps of sludge-sticky red blood cells lessens or vanishes. Gradually much of the life-sustaining blood passages are blocked off. This stage in the progress of the disease is known as the crisis. In some cases, the crisis is successfully passed but the ensuing oxygen starvation, caused by exhaustion of the red blood cells, brings death.

Heparin, the newly purified anti-blood-clotting chemical, prevents the formation of the dangerous malarial sludge in the blood. When heparin is used, however, the malaria parasites, or germs, multiply and kill by devouring the oxygen-carrying hemoglobin in the blood. Heparin makes it possible, however, to differentiate the mechanical and chemical effects of the disease and to study them separately.

New knowledge of the scavenger cells of the blood, as well as of malaria, was obtained from these color motion pictures, made possible by Dr. Knisely's adaptation of the quartz rod light for observing and photographing blood in the veins and arteries of living animals. These cells, it now is seen, "know" which material in the blood stream to grasp and which to leave alone as being harmless by a sticky substance which coats injurious substances such as germs or particles of carbon.

BONE MARROW TRANSFUSIONS

A NEW kind of transfusion, using bone marrow instead of blood, is reported by Dr. Maurice Morrison and Dr. A. A. Samwick, of the Jewish Hospital of Brooklyn, N. Y., in the current issue of the *Journal* of the American Medical Association.

Leukemia, the fatal disease in which there are too many white cells in the blood, and other rare and unconquered

blood disorders may yield to this new type of transfusion. Bone marrow transfusions have already been used, apparently successfully, in treating a 42-year-old salesman suffering from aplastic anemia. In this rare condition, unlike more familiar anemias, the blood contains too few white cells. The bone marrow stops producing white cells in sufficient numbers to make up for those destroyed.

Healthy bone marrow might stimulate the maturing of blood-forming constituents already present in the diseased bone marrow. So Drs. Morrison and Samwick drew a little less than a teaspoonful of bone marrow from the breastbone of the patient's brother and injected it into the patient's breastbone. Slightly larger doses were given in two subsequent transfusions. The patient recovered from symptoms of his illness and his blood condition also improved. But it is considered not justifiable to credit the results solely to the bone marrow transfusions until further studies have been made. Two other patients with rare blood disorders are now being treated with bone marrow transfusions.

Transfusions of healthy bone marrow, it is hoped, will help many patients suffering from various blood disorders, in the way that liver or liver extract helps patients with pernicious anemia. The latter patients lack a factor essential to the formation of red blood. This factor is supplied by liver. Leukemia patients and others with blood disorders may lack some other blood-forming factor which might be supplied by healthy bone marrow.

FOSSIL WORMHOLES

FOSSIL wormholes, chewed into the petrified wood that was part of living forest growth far back in the days of the dinosaurs, have been found in a petrified forest in the wild parts of northern China by an American missionary, the Rev. G. B. Mathews, with headquarters at the Catholic University of Peking. Father Mathews discovered the petrified forest in the course of his mission travels. Once hundreds of square miles in extent, there are to-day only scattered and isolated fragments. The rest has been eroded away in the course of many tens of centuries.

The petrified tree stumps still stand on their own roots, which itself is a rarity in fossil forests. Breaking off specimens disclosed the wormholes, as much as three inches beneath the bark. They are from a sixteenth to a quarter of an inch in diameter, and some of them contain pellets of "frass" or food waste, from the meals of the unknown larvae that chewed the wood.

No trace of the hole-borers themselves has been found, but Father Mathews is hopeful that the frass pellets can give some idea of their makers, if examined by entomologists with sufficient experience in the study of wood-boring larvae. There is, of course, the possibility that larvae or pupae of the ancient hole-makers themselves may yet be found.

Geologically, the fossil wormholes belong to the Upper Jurassic period, of an age estimated in excess of 150,000,000 years. Fossil wormholes have previously been reported in petrified wood from Egypt and South Dakota, but in both these instances the material had been poorly preserved, so that close study was not possible.

ITEMS

AN effect of total solar eclipse upon the powerful cosmic rays that incessantly bombard the earth from outer space has been discovered by investigators at the University of Sao Paulo, Brazil. This effect, hitherto sought without success, was reported by Professor G. Wataghin in a cable to Professor Arthur H. Compton, of the University of Chicago, who relayed the information to the *Physical Review*. Observations of the penetrating cosmic rays made underground show that their behavior was different from that of the total radiation.

MORE than a dozen earthquake observatories, scattered all the way from the Philippines to Alaska to New England and Ontario, have confirmed the location of the Rumanian earthquake's epicenter as being near Focsani, about 100 miles north of Bucharest. Their data, as wired to Science Service and calculated by at the U. S. Coast and Geodetic Survey, give the site of greatest disturbance as in 45 degrees north latitude, 26.2 degrees east longitude. The shocks began at 1: 38: 52 P.M., London time (November 10). The earthquake that shook Bucharest on October 22, 1802, was by no means an exclusively Rumanian affair, according to Captain N. H. Heck. This disturbance is reported as having been strongly felt all the way from Hungary to the Dardanelles. Effects on Rumanian oil fields are as yet only sketchily reported. It is improbable that any great shifts in oil pools would be made with any suddenness, but it is not at all unlikely that some, perhaps many, of the wells may have been pinched shut, necessitating costly and time-consuming redrilling.

THE bad weather that swept over the country on the Armistice week end was anything but bad for agriculture, according to reports coming in at the U. S. Weather Bureau. Heavy snows in the northern and northwestern winter wheat regions, and moderate rains farther south, benefited this important crop greatly. The precipitation was everywhere welcome and nowhere excessive; in a few places more rain is still needed. Fall pastures also show the benefits of the moisture. Late harvested crops, especially corn and cotton, are rapidly approaching completion, except where heavy snow (as in Iowa) interfered with corn picking, and heavy rains (in Texas) kept workers out of the last cotton fields. The week brought first heavy frosts to large parts of the country, reaching as far south as Arkansas and Oklahoma. In many localities these were the latest dates on record for first killing frosts.

MOUNT RAINIER'S family of glaciers will soon number only twenty-seven members instead of twenty-eight. Stevens Glacier, near Paradise Glacier, has diminished to a thin piece of ice about a quarter of a mile long, separated by about 200 yards from the main ice body of the mountain's cap. The perishing of Stevens Glacier is laid to two principal factors: less than two thirds of a normal snowfall last winter and mean temperatures averaging 18 per cent. above average during the past year. Other glaciers on Mount Rainier have shown quite irregular behavior during the current season, some of them receding more than their normal average, others considerably less.

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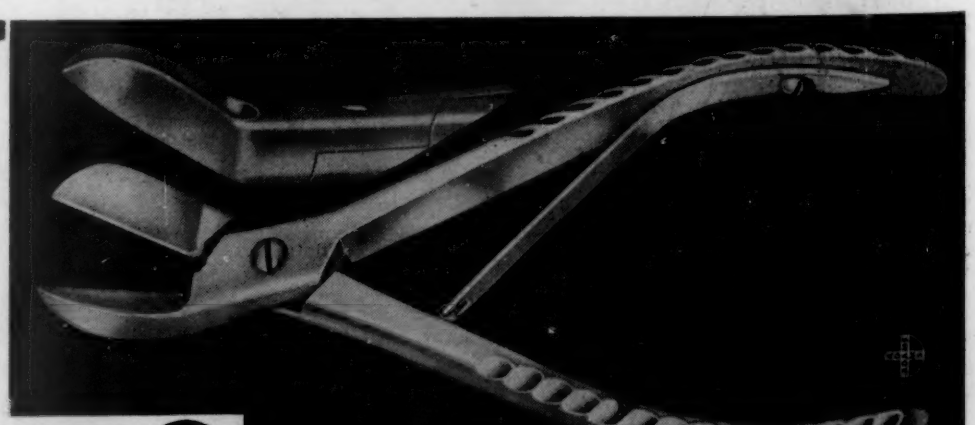

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The book has been divided into chapters, each pertaining to a particular branch of the field significant in itself and at the same time related to the general subject. This will permit the reader to acquire a knowledge of each specific branch, and perhaps to visualize logical thread running through the field, thereby simplifying and facilitating a critical analysis of the available experimental facts.

The petroleum industry, with which the authors are directly connected, has been chosen for detailed description as an outstanding example of a major industry which has been revolutionized by Catalysis. From this point of view the petroleum industry is concerning itself principally at present with the production of high octane motor fuels. However, it is indicated that in the near future synthetic hydrocarbons such as benzene, toluene, xylenes, monoölefins and diolefins, acetylenes and others will assume great importance by the applications of Catalysis. The foundation is thus laid not only for an improved petroleum industry, but also for an ample and rapid development of a new synthetic organic chemical industry.

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SCIENCE NEWS

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PAPERS READ BEFORE THE AMERICAN PHYSICAL SOCIETY

RESEARCHES conducted 14,000 feet above sea-level on Colorado's Mount Evans make it seem probable that electrically neutral particles called neutrons cause some of the cosmic rays which continually bombard the earth. At a session of the American Physical Society devoted to cosmic radiation, which has engaged a large amount of the attention of physicists in recent years, Dr. Victor H. Regener, of the University of Chicago, and Dr. Bruno Rossi, of Cornell University, announced this conclusion. Their studies were made by batteries of cosmic ray detectors covered with layers of lead. These detect mesotrons, particles similar to electrons, but about 200 times as heavy, which constitute some 70 per cent. of the cosmic radiation observed at sea-level. Since mesotrons have a very short life, a minute fraction of a second, they can not have been created very long before they are detected. Hence, it is supposed that they are formed high above the earth by some other sort of radiation which comes from other parts of the universe. Much research has endeavored to find the nature of this original radiation. The detectors and lead plates were arranged so that the apparatus would respond only to mesotrons produced by a ray which has no electrical charge, and they did show some response. Particles known as neutrons, with the same mass as the proton, one of the principal atomic building blocks, but no charge, answer this description, and it is suggested that this form of radiation is responsible at least for some of the mesotrons reaching earth.

IN another paper presented at the same session, Dr. Thomas H. Johnson, assistant director of the Bartol Research Foundation of the Franklin Institute, suggested that more mesotrons come from the west than from the east in high latitudes because the mesotrons are bent by the earth's magnetic field after they have entered the atmosphere. There are about 20 per cent. more positive than negative rays, and these are deflected so that they come to the ground from the west. Dr. Johnson worked out the formulae for such an effect and finds that the calculated behavior agrees closely with that actually observed. He suggested that experiments intended to measure the relation between the numbers from the east and those from the west, and using various thicknesses of absorbing material, like lead, would yield useful data.

IRON in meteorites which have fallen from the sky is similar in its composition to iron from terrestrial sources, according to G. E. Valley and H. H. Anderson, of Harvard University. Practically all elements consist of several chemical "twins," called isotopes, which are made of atoms slightly different in weight. Iron consists mostly, more than 90 per cent., of the isotope of atomic weight 56. The rest is largely 54 and 57, with a slight amount of 58. The experimenters determined the isotopes in both meteoric and terrestrial iron, and found them to be nearly the same. The slight differences, they said, "can be accounted for by instrumental effects. We conclude that the abundance of the stable isotopes of iron does not depend upon the place of origin of the specimen within the solar system."

SCIENCE'S newest weapon for producing intense bombardments with fragments of atoms, a device called the induction electron accelerator, was described by Dr. D. W. Kerst, of the General Electric Research Laboratory at Schenectady, N. Y. The electron accelerator consists of a doughnut-shaped glass vessel with the air pumped out of it. It contains an iron core and is surrounded by a magnet consisting of thousands of segments of iron. A stream of electrons introduced into the glass vacuum chamber is whirled in the magnetic field at ever-increasing velocities until the particles are finally moving at almost the speed of light, 186,000 miles a second. In reaching this speed, the electrons make 200,000 revolutions, traveling a distance of approximately 60 miles and building up an energy of 2,300,000 volts. The present small apparatus, less than a foot in diameter, produces radiation energy equivalent in intensity to that given off by ten milligrams of radium. Larger models can be expected to give more energy.

THE MEANING OF WORDS IN MATHEMATICS

A LOGICAL system in which the word "and," for example, might have millions of distinct meanings was described before the meeting in Detroit of the American Mathematical Society.

Dr. J. Barkley Rosser, of Cornell University, told how this "many-valued logic," once considered by mathematicians as an interesting game, had been developed with serious intent at the request of a physicist, Dr. Fritz Zwicky, of the California Institute of Technology. He thought that it would be easier to explain the atom with such a system.

In ordinary two-valued logic, a clear-cut statement is either so or not so. Thus, if one alternative can be proved wrong, the other is assumed to be true. This is the principle of the "reductio ad absurdum," or "reduction to absurdity," which has gone unchallenged for centuries.

Many-valued logic declares that instead of the two possibilities, "so" and "not so," there are any number of possibilities. When the number of possibilities is six, for instance, these might be "certainly so," "probably so," "possibly so," "possibly not so," "probably not so," and "certainly not so." Sometimes a rather general question, such as "Do you favor short skirts for women?" might be answered in these ways, but according to many-valued logic, even a precise and clear-cut statement might fall into a number of cases.

Dr. Rosser stated that the system has proved to be much more complicated than was expected. "The reason for this is that the meaning of every mathematical word depends on the fact that one uses a two-valued logic for

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PUBLISHED FOR THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
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ordinary mathematics. Allow more values, and you get more meanings for every word. What nobody had suspected was that you get a great many more meanings for every word. In a three-valued logic, there are 256 distinct meanings of the simple word 'and.' In a four-valued logic there are 14,348,907 distinct meanings of 'and.' And so on.

"All this complication makes things hard for the mathematician, but allows more freedom for the physicist. Imagine how many possible kinds of atoms a physicist could make out of electrons and protons with 256 kinds of 'and' to choose from, and how much more chance he'd have of finding one that worked the way it ought to."

AN UNKNOWN STAR IN THE CONSTELLATION OF AQUARIUS

THOUGH it "wasn't there" in his photographs, Dr. K.Aa. Strand, of the Sproul Observatory of Swarthmore College, has found a previously unknown star from the study of these same photographs. He announced his discovery at the meeting in Philadelphia of the American Philosophical Society.

The star is an invisible companion to a well-known double star, Zeta Aquarii, a member of the constellation of Aquarius, the water-carrier. This consists of two separate suns, which revolve around each other once in 400 years. Though first observations of them were made in 1779 by Sir William Herschel, Dr. Strand's photographic measurements are the most accurate so far. They are nearly ten times as precise as the best made hitherto.

In correlating these with the earlier figures, he found that the movement of the two stars was not uniform, but that there was a regular fluctuation from the expected motion, over a period of twenty-five years. These deviations "are entirely too large and too regular to be explained as systematic and accidental errors of observation, but they are satisfactorily interpreted as perturbations caused by a third invisible member of the system." That is, the gravitational pull of the unseen star pulls the others back and forth as it goes around them.

Dr. Strand concludes that the invisible companion has about one quarter the mass of the sun, while that of the entire system is four times the sun's mass. Its distance is about eighty-five light years. The two bright stars, which can be seen in a telescope, are separated by a distance about eighty-five times that between the sun and earth. The third star revolves around the brighter of the visible pair, at about twenty-six times the sun-earth distance, or about 2,400,000,000 miles.

Only twice before, said Dr. Strand, has a dark companion been found in such a way around a similar double star. The first such discovery was made in 1881, of a star in the constellation of Cancer, the crab; and the second was in 1905 of one in the great bear, Ursa Major.—JAMES STOKLEY.

THE HEIGHT AND INTELLIGENCE OF CHILDREN

(*Copyright, 1940, by Science Service*)

PARENTS of children who are "too tall for their age" should not waste worry on their gangling offspring. On the contrary, they should be thankful they are that way, for they are very likely to be brighter than average as well as taller than average.

This was one of the points brought out in an address before the meeting of the American Philosophical Society by Dr. Franz Boas, professor emeritus of anthropology at Columbia University. For the past year he has been making a special study of the correlation between height-for-age and intelligence quotient in school children.

"Children short for their age had an intelligence quotient markedly under the norm," he reported, "those tall for their age, one above the norm." This finding is corroborated by the statistical evidence of another investigator, who found that "children of the same age are the taller, the higher the grade they had attained in school. In other words, their physical and mental development went hand in hand."

Great variability in human stocks, even in fairly closely related groups of individuals, was another point discussed by Dr. Boas. Variable traits included not only the obvious physical characters but also physiological and mental ones.

Exhibiting a chart which outlined strongly the great differences that can arise within such a related group, he pointed out: "This is one of the strongest proofs showing that it is an utter error to ascribe the same qualities to a whole population—too often called a race. The genetic lines composing a race are so varied that the assumption that all members are by heredity endowed with the same physiological and mental characteristics is as absurd as to claim that they are physically alike."—FRANK THONE.

THE OUTPUT OF SCIENTIFIC WORKERS

UNDER pressure of the war emergency, scientific workers in England have been trying to accomplish more by increasing the length of their working day. Now the question is being raised, Does the long working day really pay in increased output? How much can the day be lengthened without harm to the work and the worker? Some of the disadvantages of a very long work week for brain workers are discussed in a recent issue of *The Scientific Worker* published in London by the Association of Scientific Workers.

In the English industrial laboratories under study, three plans of working week have been tried. Under one plan, the work goes right on through seven days a week for a total of 66 hours. That would mean about nine and a half hours of work every day. Another plan is to have one day free in eight and work 57¾ hours a week. Under the third, workers put in 56½ hours a week and have one day free in each seven.

There is no good way to measure the amount of thinking a brain worker does in the course of his week's work. The value of what he accomplishes may not even be recognized during his lifetime. It is necessary in estimating the efficiency of this type of work to rely on the general impression among the staff.

At first more work was done in the long week. This made it possible for certain work to be accomplished earlier than would otherwise have been possible. But

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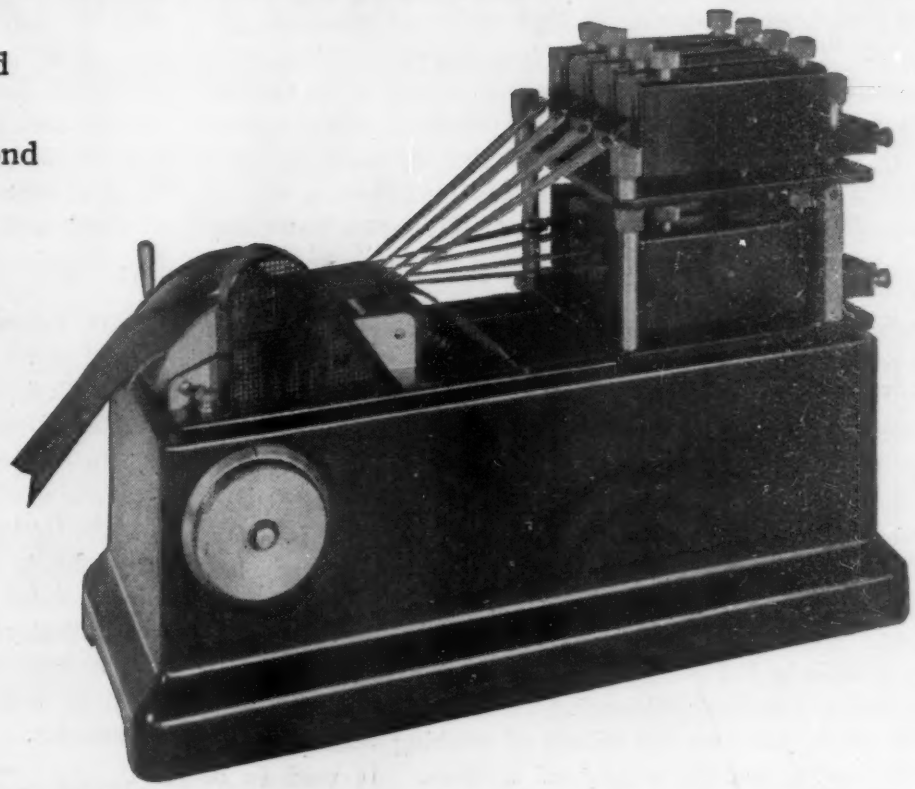

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now, the feeling is, little if any more work is being done than during the peacetime week of 44 hours.

Mental fatigue is so insidious that it leads to involuntary time wasting. In a normal working week, experiments in progress toward the end of a working day would be completed on overtime. Now such operations are not started late in the day. In a normal week, difficult problems coming up in the evening can be left to be tackled in the morning when the mind is fresh. After a long day and a short and disturbed night, the mind is never fresh. Scientific workers, it is explained, have a way of spending their leisure in a sort of busman's holiday fashion by reading scientific books or journals and by going to technical meetings. All this voluntary contribution to the value of their work is lost under a long work week.

Under plans giving free days, it was found that the scientific laboratory does not reap the benefit of staggered off-days as does the factory, where the purpose is to keep facilities in total use. Scientific workers usually work in teams; when any member of a group is away, the work is interrupted. Staff consultations are less valuable when some members are absent from every meeting.

Britain's Industrial Health Board summarizes in a recent government publication the research they have done in recent years on the effects of working hours on both the health and the output of workers. It used to be thought that worker's and employer's interests were opposed—the worker wanting plenty of leisure and pay, the employer wanting the most work for the least expenditure. But now psychological researches into industry have shown that the best conditions of work for the greatest output are exactly the same as those that give health and a low accident rate to the worker.

When hours are long, frequent rest periods were found to be essential. Psychological fatigue can be relieved best by rest pauses combined with a rotation of operations. Ventilation is important in preventing fatigue and reducing accidents. Ventilation and illumination provide new problems under blackout conditions.

It is pointed out that hours of work must be considered in connection with out-of-work requirements of the workers. In some of the laboratories studied, workers had to spend as much as three hours in travel getting to and from work each day. This time can not be counted as working time, but neither is it contributing to the rest or recreation of the worker.—MARJORIE VAN DE WATER.

ITEMS

THAT Rumania's ruinous earthquake was born far beneath the surface of the earth is indicated by word received by Science Service. The focus, or actual rock slip that started the tremors, was 150 kilometers (93.2 miles) down, according to calculations made independently at the Seismological Laboratory, Pasadena, Calif., and the headquarters of the Jesuit Seismological Association in St. Louis. At St. Louis the epicenter's location is calculated as in approximately 46 degrees north latitude, 27.2 degrees east longitude.

SHORELINES of a sea that 450 million years ago flowed where now the Rocky Mountains rise were traced during the past summer by Dr. Charles E. Resser, paleontologist of the Smithsonian Institution. Fossils of animals that once lived in its waters were his guides. This sea, dating back to the Cambrian geologic period, stretched from Alaska to Lower California. High land, about where the Sierra Nevada now stands, was its western boundary. To the east, there was lower land near the present location of the Rockies. Dr. Resser was able to tell where the sea shoaled out toward the shorelines by the presence of fossil beds considerably thinner than the normal bottom deposits already known.

THE fastest climbing airplane in the world, able to ascend more than a vertical mile in a minute, has just had its first public demonstration. Made by the St. Louis Airplane Division of the Curtiss-Wright Corporation, and known as the Curtiss Model 21B, it is a highly streamlined, single-place, low-wing monoplane, powered by a Wright Cyclone engine. It is one of a large number now being built. A speed of 330 miles per hour can be attained, which gives it great maneuverability, and increases the difficulty of ground forces in locating the ship. It has four machine guns, which fire through the propeller disk, as well as radio equipment and military aircraft accessories.

BUSES operated by Diesel engines have proved satisfactory in more than a year's service between Chicago and California, according to W. A. Taussig, of the Burlington Transportation Company, speaking before the meeting of the National Fuels and Lubricants Committee of the Society of Automotive Engineers at Tulsa, Okla. In the first few months of operation, during the summer of 1939, a great deal of trouble was experienced with engine failure. However, these difficulties were overcome and changes were made in the engines to improve their service. As a result, seventeen more buses were added to the original fleet of twenty-one. "A fuel saving of approximately 30 per cent. has been realized by the introduction of Diesels," Mr. Taussig stated. "While there have been some exceedingly discouraging experiences in the past, it now appears that the hardest part of pioneering is over, and unquestionably, in the future, more and more operators will avail themselves of the possibilities of fuel economies through Diesel operation."

Two kinds of organic molecules have been rendered visible by the electron microscope in Germany, according to information reaching Dr. Stuart Mudd, of the department of bacteriology of the Medical School of the University of Pennsylvania. Dr. Mudd is chairman of the committee on the electron microscope of the National Research Council. The organic substances, the molecules of which have been made visible, are hemocyanin and edestin. Both are proteins. Hemocyanin or hematocyanin is a blue respiratory pigment in the blood of mollusks and arthropods. Edestin is a pure crystalline protein obtained from oil of castor beans, hemp seed and other seeds.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE AUTUMN METEOR SHOWER AND ENCKE'S COMET

IF, during the autumn, you notice a shooting star that seems to emerge from the constellation of Taurus, at present in the eastern evening sky, you are probably seeing the remains of a huge comet that may have been watched with fear and wonder many thousands of years ago by our late Stone Age ancestors.

These meteors are members of the Taurid shower, so called because of the direction from which they come. According to Dr. Fred L. Whipple, of Harvard University, who prints a report on his researches in the current issue of *The Telescope*, the Taurids seem to be cousins of the puzzling Encke's comet. It comes around once every three years and four months, but is never visible to the naked eye.

From observations of Taurid meteors, with special cameras, he finds that their speed around the sun varies from 23.3 to 23.5 miles per second. This shows conclusively that they are part of the solar system, moving about the sun in a closed path. Had they been moving faster than 26.5 miles per second, they would have come in from outer space. This, indeed, had been suggested in the past, but Dr. Whipple finds the reason for such an erroneous conclusion. The meteors that are seen in early November have longer and narrower orbits than those that come in late October, and this led the earlier astronomers astray.

Dr. Whipple also finds that the paths of the meteors are quite similar to that of the comet, except that the planes of the meteor and comet orbits are at an angle of about 12 degrees. This would seem to preclude the possibility of a connection, but he has worked out a new mathematical theory for the pull of Jupiter on the comet. The plane of the comet's motion wobbles over a long period of time. Many thousands of years ago the orbits were nearly the same.

"The most reasonable conclusion to be drawn from this evidence," Dr. Whipple says, "is not that the Taurid meteors arise from Encke's comet, but rather that they both have a common ancestor, some large comet that broke up into several smaller ones. One of the smaller descendants can still be seen alive as Encke's comet, while only the skeletal remains of others occasionally collide with the earth to produce showers of meteors. It is interesting to know just how long ago the parent comet met with disaster and we may estimate from the present data that the break-up probably occurred some five thousand to fifteen thousand years ago."

First observed in 1786 by a French astronomer named Mechain, Encke's comet has been watched on forty or more visits since then. Its three-and-a-third-year period is the shortest of any periodic comet. Unlike most comets, the name commemorates not the discoverer, but a German, Johann Franz Encke, who first showed that it was a periodic comet. He also made an exhaustive mathematical study, which showed that its period was gradually shortening. Between 1819 and 1914 this amounted to about two and a half days. However, after Encke's death in 1865 the rate of decrease was considerably reduced and in recent years the period has hardly changed at all.

Encke's suggestion that the decrease was the result of some cloud of resisting material through which the comet passed has thus been discarded, because, says Dr. Whipple, "a resisting medium dense enough to affect the comet's motion could hardly disappear in a few years." The reason for this change is an astronomical puzzle. So, indeed, is the fact that the comet still exists. Because it moves in a small orbit it "is activated by fairly intense sunlight at all times and brightens up every three and one third years when it approaches the sun. How it can continue to show indefinitely as a hazy diffuse object and not be completely dissipated is truly a mystery."

THE PHOTOGRAPHIC IMAGE

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AFTER working with photography for years, investigators at the Kodak Research Laboratories in Rochester have found out how the developed silver bromide grains that make up the photographic image really look. It used to be thought that if magnified sufficiently the grains would appear like lumps of coke. Now, thanks to the electron microscope, which is as much more powerful than the ordinary miscroscope as that instrument is superior to a hand lens, they find that each grain is like a mass of seaweed. If you take a piece of ordinary sewing thread and roll it between your fingers into a small, loose ball, you have a good model of a single grain.

These results have been announced by Dr. C. E. K. Mees, vice-president and director of research of the Eastman Kodak Company. They are shown in photographs, with magnification of 25,000 diameters, made with a type of electron microscope developed by Dr. E. F. Burton, professor of physics of the University of Toronto, a pioneer in the electron microscope field. The Kodak Laboratory's installation was built by C. E. Hall, a student of Dr. Burton's, who is now on the laboratory staff.

Dr. Mees is unwilling to predict what these results may lead to, but knowing what the grains look like, it will be possible to understand better the mechanism by which they are formed, and control it better. Already they have a clue to the different behavior of different developers. Hydroquinone, for example, gives relatively coarse threads, while metol gives threads that are much finer. These seem to build up from one spot on the original crystal of silver bromide. With developers like paraphenylene-diamine, and also with physical development, the silver bromide dissolves and precipitates elsewhere, so the result is a fluffy mass rather than a thread.

After the work was begun, it was found that earlier in the year a German named Ardenne, also with the electron microscope, had made an independent discovery of the thread-like character of the silver bromide grains, but no details of this work have yet been obtained.

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THE CONTROL OF MALARIA IN CHINA

DR. L. L. WILLIAMS, JR., U. S. Public Health Service, after six months spent inaugurating malaria control work on China's life-line, the China-Burma Highway, considers the control of malaria "the greatest problem confronting the Chinese."

This health problem, which militated against the building of the road and slowed up the carrying in of war supplies, is now being solved by measures for the protection of labor camps and headquarters towns inaugurated by Dr. Williams and his associates, Dr. Bruce Mayne and Surgeon H. J. Bush, of the U. S. Public Health Service.

American investigators were sent on this malaria control mission at the request of the Chinese Government when epidemics began to appear along the Burma Road. "It is now thought," Dr. Williams told a conference at the National Institute of Health in Washington, "that malaria is responsible for more deaths than all other infectious diseases in the province (Yunnan Province) and that hundreds of thousands of young adult lives are damaged annually."

Malaria control work begun at Chefang and also at the airplane factory of Loiwing, the "two worst places" of danger from the disease. Chinese physicians were taught malaria control methods, ranging from the use of oil and pyrethrum to kill malaria mosquito larvae to making screen doors to protect the people in their houses. Most of these physicians now have been appointed by the Chinese National Health Administration, Wei Shang Shu, as the first malaria control unit for the China-Burma Highway, with headquarters at the Cheifang Laboratory set up by Dr. Williams and associates.

THE SUPPLY OF RUBBER

EVIDENCE that the United States is rapidly approaching the time when it will no longer be dependent on the supply of rubber from the Dutch East Indies, Borneo and Sumatra, is contained in figures released by the U. S. Bureau of Census.

A preliminary report on plastic material compiled from the Census of Manufactures data, collected in the continental United States and covering 1939, records the fact that the production of plastics and synthetic resins other than nitrocellulose, cellulose acetate and coal tar resins had jumped from $13,568,113 in 1937 to $30,039,151 in 1939. This is more than a twofold increase.

In this class, it is explained, are included photographic film base, ethyl cellulose, synthetic rubber and rubber substitutes. The production of these individually can not be shown separately without disclosing the output of separate factories.

Pointing out that no native rubber is now available in the continental United States, the bureau says: "It may be that some time in the near future the United States will be able to forget the importance of East Indian rubber groves to its economic well-being as it has been able to forget that the only commercially worth-while nitrate deposits are in Chile, since science has discovered a method of obtaining this precious essential from the atmosphere."

In 1939 there were 38 plants primarily engaged in the production of plastic materials and synthetic resins, which were four more than in 1937. They turned out $77,653,314 worth of products, of which more than $63,000,000 was in plastic materials. In addition, nearly $17,000,000 worth of plastics were produced by other industries, bringing the total value of plastics production for the year to $79,752,810, compared with $61,877,690 two years previously.

Last year the industry paid out $4,757,869 in salaries for 2,061 workers, and $9,839,935 in wages, to an average of 6,966 wage earners.

As examples of the products made of plastics, the bureau cites optical frames, frames for binoculars and goggles, transparent containers for toothbrushes, perfumes, cosmetics, bath salts, shaving soap and other toilet goods, room decorations, salad and fruit bowls, washing machines, etc.

THE SUPPLY OF NITRATES

SEEKING new customers for nitrates, in the world's trade upheavals, Chile is casting a hopeful eye toward the United States, according to a report made to the American Council of the Institute of Pacific Relations in New York City.

The United States is now rated about 75 per cent. self-sufficient in nitrates, valuable in fertilizer and in making war explosives, and for other industrial processes. With shipping and trade hampered by war, Chile sees a good chance of replacing Germany, the United Kingdom and the Netherlands as one major source for the 25 per cent.

Revival of sales of nitrate to the United States, which sagged noticeably during depression years, would materially help in Chile's economic problems, since the European war is blamed for loss of about half of its foreign sales of nitrate. Japan looks mainly to Chile for her imports of this material, but even if the war causes an increase of its purchases as expected, the amount that it buys is comparatively small.

Dramatically different is the present situation from that in the last war, when Chile enjoyed the strategic position of being the world's main dependence for nitrates for explosives. Production in 1916 leaped to almost 3,000,000 tons. Since then, synthetic means of producing nitrate commercially have been chiefly responsible for the decrease in sales. In 1933, Chile was supplying only 4 per cent. of the world's nitrate, but the industry, reorganized, has in recent years been improving its competitive position.

RESULTS OF THE CENSUS

CHANGES in the American way of life that have been taking place during the past quarter-century are shown up in facts and figures now developing, as the 1940 Census is being digested, according to a report made by Dr. Vergil D. Reed, assistant director of the Bureau of Census, to the Washington Academy of Sciences.

Nowhere, perhaps, are these changes more dramatically evident than in the field of personal transporation. In 1914, the country's production of carriages, sulkies and buggies numbered 550,401. In the same year only 543,881 passenger automobiles were manufactured in the

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United States. In 1939, fewer than 1,000 carriages were built, while the assembly lines ground out 4,362,000 autos.

Canned fruit and vegetable juices were not even mentioned in the Census of 1914; to-day the combined value of citrus and other fruit, and tomato and other vegetable juices annually canned and bottled is about $50,000,000.

Another field in which large development has taken place, Dr. Reed pointed out, is that of the personal service industries, like beauty parlors and cleaning and pressing establishments. To-day personal service businesses of this kind through the land number 321,000 and support more than 570,000 proprietors and employees. Such service establishments, according to recent Census of business figures, reported receipts of $684,000,000, paying out wages amounting to $168,000,000.

Taking the Census, Dr. Reed stated, was a major industry in itself. There were 130,000 enumerators, who covered a continental area of 3,026,000 square miles and an additional territorial area of 711,000 square miles, inhabited by about 150,000,000 people. They visited more than 35,000,000 homes, 7,000,000 farms, 2,000,000 business establishments and 165,000 manufacturing plants in the 3,000 counties of the United States, divided into 143,000 carefully mapped districts.

THE GROWTH OF POPULATION IN THE UNITED STATES

A WARNING that people in the United States must make difficult adjustments in social and economic life to meet developments shown by the 1940 Census, is sounded by two population experts, Dr. Warren S. Thompson and Dr. P. K. Whelpton, of the Scripps Foundation for Research in Population Problems at Miami University. They state in an article to appear in *The American Sociological Review* that "the pattern of population growth in the United States during the past ten years differs significantly from that of previous decades."

The main changes to watch, because they have significant influence on economics and social problems, are these:

1. The more rapid growth of the South than of the Northeast.
2. Increasing proportion of the population in smaller cities and suburban areas.
3. Rapid declines in certain rural sections and increases in others.
4. Trend toward an older population.

It is estimated that the largest absolute increase in population, 5,273,000, is among middle-aged people in the 45- to 64-year group. This is the group said to have increasing trouble in finding work in industrial plants and commercial establishments. Rapid growth of this part of the population is seen aggravating the already serious problems of teaching older workers new tasks.

The oldest group of Americans, people of over sixty-five years, are also increasing at a rate which equals the growth of the entire nation fifty years ago. These elderly people, who are apt to be not entirely self-supporting, will continue to increase at about the present rate for 20 or 30 years.

It is almost certain that in the nation as a whole the proportion of the population living in rural areas has increased for the first time in the history of the Census.

Some time will elapse before the new 1940 Census figures are released showing exactly what is happening to population in the smallest cities of less than 10,000 and among farming and non-farming people in rural neighborhoods. The population analysts think that non-farming people of country neighborhoods will prove to be increasing faster than the farmers.

ITEMS

THE first major football games to be televised and the first to be broadcast by short wave in Spanish for the benefit of South and Central American listeners—these are two of the records being set this fall by games of the University of Pennsylvania at Franklin Field, Philadelphia. The television broadcasts are through station W3XE of the Philco Corporation. From the cameras on special scaffolds, the signals are transmitted over co-axial cables to nearby Convention Hall, on the roof of which is a special relay transmitter used several months ago in televising the Republican Convention in the same building. This sends the signals to the W3XE transmitter in North Philadelphia. The Spanish short wave broadcasts are through the Columbia short wave station WCAB.

MACHINES which shake automobiles from outside and inside, forming part of the equipment used in testing rubber for its many automotive applications, were described at a meeting of the Washington Section of the Society of Automotive Engineers by Roy W. Brown, in charge of the Automotive Research Division of the Firestone Tire and Rubber Company. The elastic properties of rubber are some thirty times greater than those of steel. Applying them has given new standards of quietness and performance in modern automobiles. Though rubber has been used so long, data concerning some of its important properties have been lacking, so Mr. Brown and his associates have determined many of these. Among the special machines for such studies is a shaker which can be attached to the automobile engine, to give vibrations in any direction desired. Another is a set of rollers on which it can be driven, so as to provide a close reproduction of the roughest road.

DIESEL engines, which in 1926 weighed as much as 267 pounds per horsepower, are now made as light as ten pounds per horsepower, was reported by H. C. Mougey, of the General Motors Corporation, to the Division of Refining of the American Petroleum Institute, meeting in Chicago. "If it should be desirable for special purposes such as national defense to decrease these weights," he said, "it should be possible to develop diesels of large power output with weights as low as three pounds per horsepower." Lubricating oils for automobile engines are having to meet much more severe demands than a few years ago, on account of the progress that has been made in engines, fuels and roads. Tests made in the laboratory with straight mineral oil, using extra large filters, showed that the same oil could be used for many hundreds of hours with no appreciable effect on the oil, pistons, rings or bearings. Such filtering, however, is not practicable in normal use.

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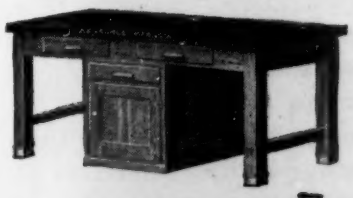

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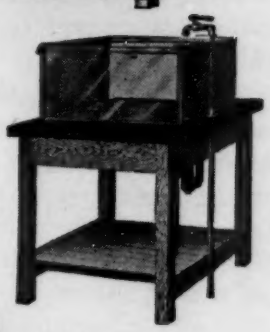

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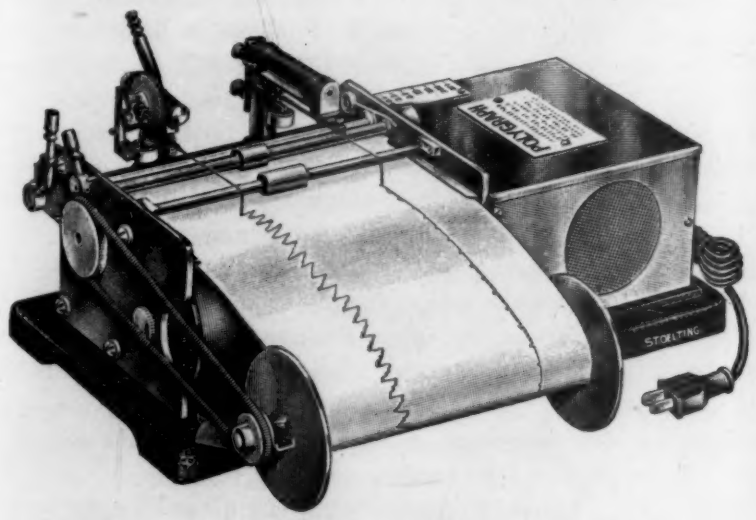

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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW SUPER-DENSE STAR

A NEW addition to the rare class of white dwarf stars, which have densities as much as a million times that of water, has been announced by Dr. G. P. Kuiper, of the McDonald Observatory of the University of Texas and the University of Chicago.

It is in the constellation of Cygnus, the swan, just above the top of the familiar "northern cross," visible in the western evening sky. The star, known by its catalogue number as Ross 198, is of the fifteenth magnitude, and not visible except with the largest telescopes.

The faint companion to Sirius, the "dog star," now seen in the evening to the southeast, was the first white dwarf to be discovered. Though it has as much stuff in it as the sun, this is concentrated into a globe about as big as the planet Uranus, one thirtieth of the sun's diameter. Thus, a pint of its material would weigh about 20 tons.

Explanation of this super-density is believed to be that the atoms are completely ionized, or broken into bits, by the extreme temperatures that prevail inside, about two billion degrees Fahrenheit. Thus, the wood in a pile of boxes, corresponding to the atoms and like them containing a great deal of empty space, takes up a lot more room than if the same boxes are broken into small pieces.

Just how dense is the newly discovered white dwarf, Ross 198, remains to be determined. However, another star of the same class that Dr. Kuiper discovered a few years ago is estimated to be a thousand times as dense as the companion of Sirius.

THE ANNUAL EXHIBIT OF THE CARNEGIE INSTITUTION AT WASHINGTON

EXPLODING stars, known to astronomers as "supernovae" and described as "the rarest and most spectacular phenomena recorded in the study of the observable region of the universe," are of two types. This is shown by a survey conducted jointly by the Mount Wilson Observatory of the Carnegie Institution of Washington and the Palomar Observatory of the California Institute of Technology. Some results of this investigation, of which the exploratory phase is now completed, is shown in the annual exhibition of the Carnegie Institution of Washington, opened on December 13.

Ordinary "new" stars reach a maximum brightness only about 100,000 times that of the sun. Such a star, says the catalog of the exhibition, "becomes unstable, swells up, and blows off its cover." Several of these occur each year in our own Milky Way system, and presumably they are about as frequent in the millions of similar systems observed by astronomers. In the more distant ones, even when brightest, they are not sufficiently brilliant to be apparent.

Until the joint investigation was inaugurated, six years ago, only fragmentary information about supernovae, which are far more brilliant, was available. Now it is found that one appears in each star system about once in three to six centuries. The last in our system was in 1572.

"All well observed supernovae seem to follow closely one of two patterns," it is announced, "and are distinguished as groups I and II. Those of group II are the fainter (average maxima about 10,000,000 suns) and their spectra, that is, analyses of their light, resemble the spectra of normal novae on an enhanced scale. Practically all the features in the spectra have been identified. The spectra of group I (average maxima about 100,000,000 suns) are quite different, and so strange that scarcely a single feature has yet been identified with certainty. These spectra evidently reflect the sudden release of energy on an enormous scale, and their final interpretation should contribute information concerning the behavior of matter under extreme conditions."

Pressures in the laboratory as great as three million pounds per square inch, which duplicate those at a depth of 300 miles below the earth's surface, or about a twelfth of the distance from surface to center, are proving a powerful new tool in studies of what is happening in the earth itself.

First results of researches made with such pressures in the Geophysical Laboratory of the Carnegie Institution of Washington will be shown at the annual exhibit of the institution.

To obtain such pressures it is necessary to have a material that will withstand them. Tungsten carbide, known as carboloy, is one that has been widely used, but even with this the trick of "a bomb within a bomb" is needed.

"A carboloy piston 1.13 inches in diameter (roughly one square inch in cross section) will support a load of about 375 tons before rupture," it was stated. "It is one of the strongest known materials. This compressive load thus appears to set up an upper limit to the pressure obtainable in a single-stage apparatus. If, now, we support this piston laterally by a pressure of, say, 250,000 pounds per square inch, on the basis of ordinary elastic theory we can expect the piston to support a load of about 500 tons as an upper limit. Actually, however, it will withstand much more than 500 tons, because the lateral confining pressure acts also to increase its strength. A piston supported in this manner withstands a load of as much as 1,500 tons.

"This phenomenon has been utilized in the apparatus for work at very high pressures. The apparatus consists of a two-stage or cascaded arrangement of pressure vessels, that is, a bomb within a bomb. A pressure of 300,000 pounds per square inch developed in the first stage or outer pressure vessel acts on the second stage or inner pressure assemblage to support and also to strengthen it, and thus allows the generation of a pressure about ten times that in the outer vessel. The advantage of this two-stage cascade apparatus, therefore, lies not only in the circumstance that the second stage immediately doubles the pressure range, but also in the great increase of strength caused by the confining pressure on the inner

bomb. The pressure in each stage is developed by means of a piston, and the mechanism is so designed that the pressure in either stage may be varied independently of the other.''

COLD LIGHT FOR TELEVISION

THE woods are spooky when decayed tree branches become phosphorescent and glow in the dark. In much the same way, faces of clocks shine in the night if the hands and figures of the hours are phosphorescent. And everyone is familiar with the uncanny gleam of the cat's eyes as they ''shine'' in the darkness. While the cat's eye merely reflects light, the ''eye'' or screen of the tele-receiver actually produces ''cold light.''

This result is based on luminescence—''light emission not directly attributable to heat.'' Radio now takes up the age-old art of luminescence, applying it to man's conquest to ''see at a distance.'' For the art of luminescence, optics and lenses, radio research promises much that is new. They are keys to the future of television.

Having caught the clue that tiny crystals of specially synthesized luminescent materials have the unique property of transforming electron energy into light, the research experts, now fashioning kinescopes or ''tele-eyes,'' are studying the historical, theoretical and practical features of the effect.

Revealing hitherto unpublished data, Humboldt W. Leverenz, of the RCA Laboratories, states that the art of luminescence is having a rebirth, although synthetic luminescent materials have been known for 337 years. He explains that the term ''cold light'' is concisely descriptive of these ''glow materials.'' And he goes on to point out that in television a scientific word—''cathodoluminescence''—comes into prominence. The name is derived from the fact that light emission is occasioned by cathode rays or electrons, which are electricity in buckshot form, that impinge on luminescent matter.

Alchemists were a long, long way from television when, in 1603, they synthesized phosphors by crude methods, such as by heating oyster shells with sulphur to produce a feeble violet-phosphorescence. Now, along comes television to accelerate the old oyster shell technique. The intense search of literature on the subject of luminescence has disclosed, according to Mr. Leverenz, ''a plethora of phosphor recipes,'' but few work successfully.

First of all, to serve on the eye-like screen of radio, a luminescent ingredient must be pure; in fact, it must possess a degree better than ''spectroscopic purity,'' as Mr. Leverenz describes it. To the visitor the laboratory looks like a hospital operating room. And, incidentally, the air is kept so pure that a burning gas flame is invisible; there are no impurities to burn.

To show the complexity of the trick, Mr. Leverenz calls attention to the fact that there is no theory of luminescence adequate to explain quantitatively all the properties of known phosphors, or to predict the properties of new ones. But he does know that in regard to luminescence, so vital in television, all efficient phosphors are definitely crystalline. But those intended for the kinescopic ''eye'' must give off light of a color that the eye can easily see, if maximum efficiency is required. Therefore, all phosphors are not suitable for television.

Many factors must be taken into consideration in fashioning retinas for television. Evidence that eleven years of intensive television-luminescence research in the RCA Laboratories have been rewarded with success is found in the statement by Mr. Leverenz that the kinescope now can provide high enough levels of flicker-free picture brilliancy to be adequate, not only for the normal eye, but also for the defective eye. He quotes statistics to report that approximately two fifths of the population, comprising millions of people, have defective visual functions which must be considered in establishing a public service such as television.

GLYCERINE FROM PETROLEUM

GLYCERINE, the important industrial chemical used in the manufacture of explosives for America's defense program as well as in more peaceful pursuits, such as the manufacture of resins for varnishes and lacquers and the processing of tobacco, can now be made from petroleum. Dr. E. C. Williams, vice-president and director of research of the Shell Development Co., Emeryville, Calif., speaking at the New Orleans meeting of the American Institute of Chemical Engineers, described the new process.

At present obtained as a by-product from the soap and fat-splitting industry, the price and supply of glycerine have been subject to wide variations. In 1917 it rose to 70 cents per pound and was difficult to obtain even at that figure. At that time it was made in Germany by a fermentation process, to the extent of about 13,000 tons annually, but this method involved many commercial difficulties.

The first step in the Shell process is the isolation of a gas, propylene, from the petroleum. Then comes a reaction with chlorine gas to form allyl chloride. This is treated with caustic soda to form allyl alcohol. In an alternate step, glycerine chlorhydrin is formed instead. The last step is the production of glycerine from one of the last two products.

In explosives manufacture the glycerine is treated with nitric acid to form nitroglycerine. This is used to make dynamite and also some military explosives. The British explosive, cordite, also requires glycerine in its production.

Dr. Williams stated that the glycerine produced by the new method ''is of excellent quality, meeting easily the specifications of the most rigorous user with whom we have yet come in contact.''

NUTRIENTS FOR PLANT ROOTS FROM DRY SOIL

THE classic theory that plants can draw mineral salts only from a liquid solution has been disproved by Dr. Hans Jenny and Roy Overstreet, of the College of Agriculture of the University of California, who have shown that plant roots have the power, under certain conditions, actually to secure nutrients directly from dry soil particles.

This discovery was made during a study of the absorption of radioactive potassium and sodium by plant roots. Radioactive atoms of nutritional elements, produced in

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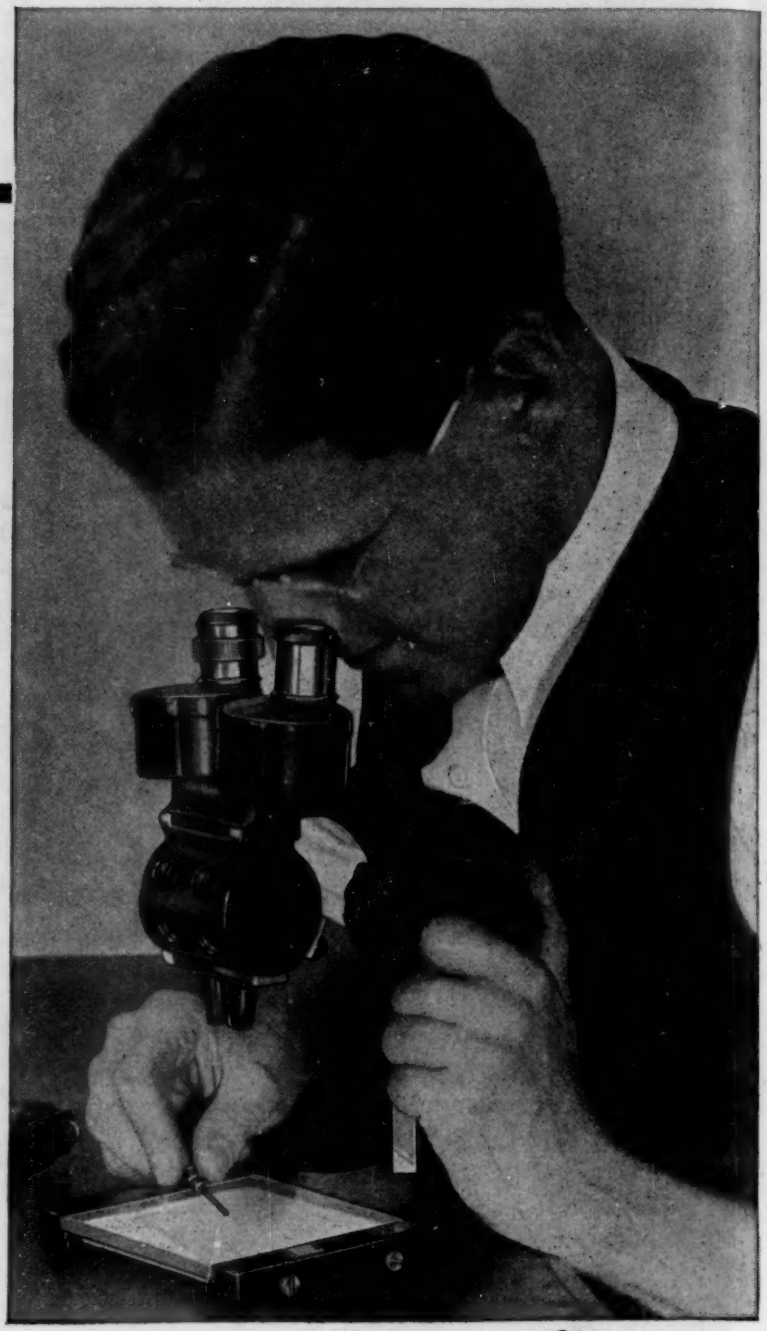

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the cyclotron, have made it possible to learn much about plant life, and is particularly valuable in the study of plant nutrition.

Charged atoms of potassium and sodium were combined with the regular elements and mixed in the soil surrounding test plants. By use of a vacuum-tube tracing device, the irradiated atoms can be followed; from the soil, through roots, up stems and into leaves or whichever part of the plant finally absorbs the elements.

Dr. Jenny and Mr. Overstreet found that when a root surface came into close contact with a clay particle coated with potassium or sodium atoms, these began to be absorbed directly into the root cells. It was not necessary for them to be first dissolved in water in the soil.

The commonly accepted view held for many years has been that nutrients held in soil are dissolved by water into what is known as the soil solution, and that all plant food is absorbed from this solution. This new discovery now shows that while this action is undoubtedly very important, it does not explain all conditions under which plants take food from the soil.

TROPICAL AMERICAN DIET

THAT food and nutrition should be a "must" item for consideration in a program for Western Hemisphere solidarity, was pointed out by Dr. George R. Cowgill, associate professor of physiological chemistry at Yale University, in a De Lamar lecture at the Johns Hopkins School of Hygiene and Public Health.

Many of the dietaries in common use in Tropical America are "far from satisfactory in several respects," Dr. Cowgill found from his own observations during two summers in Panama and other Tropical American countries. Dr. Cowgill made his studies of the possibilities of nutritional research among the natives in Panama at the request of Dr. Herbert C. Clark, director of the Gorgas Memorial Laboratory.

Tropical American diets lack calcium and vitamin A particularly, Dr. Cowgill found. Advice to consume more milk to make up the calcium deficiency would be impractical because a dairy industry is practically non-existent except in particular sections of Tropical America.

The Mexican Indians use lime in removing the bran layer from the corn kernel and this results in addition of calcium to the final edible product, probably accounting partly for the splendid condition of the teeth seen in most of these people. Dr. Cowgill suggested that other Tropical Americans might be helped to get more calcium in their diets by development of other similar uses for lime. He believes that better returns on American capital invested in development of natural resources in Tropical America can be obtained from improvement, through food and other means, of the health of the local tropical laborers.

"If the purely humanitarian consideration of improvement in the health of all groups of people, regardless of locality, race and other considerations, does not constitute sufficient reason for becoming interested in nutritional problems of Tropical America," he said, "then I offer the one just stated which is related definitely to an enlightened self-interest and a matter of dollars and cents."

ITEMS

GATHER acorns, horse chestnuts and beechnuts to eke out the feedstuff supply for farm animals and thereby release tonnage for other needed imports, is the suggestion in *Nature* of Dr. R. Melville, of the Royal Botanic Gardens at Kew. Both oaks and horse chestnut trees have borne bumper crops this year and in the present national emergency they should not be permitted to go to waste. Horse chestnuts are slightly bitter, but most farm animals soon come to like them. Only pigs persistently refuse them. They can be fed "as is," but it is considered best to gather them in quantities in central depots where they can be dried and ground. Acorns can be stored in underground pits, where they will keep very well for a long time, if they are not permitted to get wet. They can be fed fresh or dried, but it is not recommended that they be given to young animals, which are sometimes poisoned by them.

WOOD can be converted into an easily bent and molded plastic by a new process developed at the U. S. Forest Products Laboratory at Madison, Wis. Worked into any desired shape while hot, the plasticized wood becomes as stiff and strong as ever upon cooling. The new treatment is a by-product of the research on the chemical seasoning of refractory woods. It was found that oak, soaked in a concentrated solution of urea and then dried, became plastic when heated to about the boiling point of water, though the wood was still dry. It remained plastic while hot, and resumed its normal "woodenness" upon cooling. Sawdust and chips, similarly treated, can be heated and pressed into any desired shape. This material is self-bonding, that is, it sticks together without the addition of any outside adhesive. Thus far, the new process has been used principally on hardwoods, particularly several species of oak. However, preliminary experiments indicate that softwoods like juniper and Sitka spruce will also give good results under the same treatment. Patents covering the new process have been applied for by the Forest Products Laboratory.

THE Forest Service keeps close track of the cost of suppressing forest fires. In 1934, a fire in the Nezperce National Forest in northern Idaho cost $12,000 to put out, when fire-fighting crews moved in by truck and on foot. During the fire season just closed, another fire occurred in the same area. This time two parachute jumpers formed the spearhead of the attack, and the cost was held down to $500. Another comparison was made even more directly, when ten fires were reported in one day, on the Bitterroot National Forest in Montana. Two of them, in inaccessible areas, looked as though they might become bad ones, so planes flew over and dropped crews of "smoke jumpers," with tools and provisions. The other eight were attacked in the orthodox manner, by crews going on foot from roadheads. It cost only $160 each to suppress the fires attacked by the parachutists. The ones put out by ground crews alone cost from $2,000 to $17,000 apiece.

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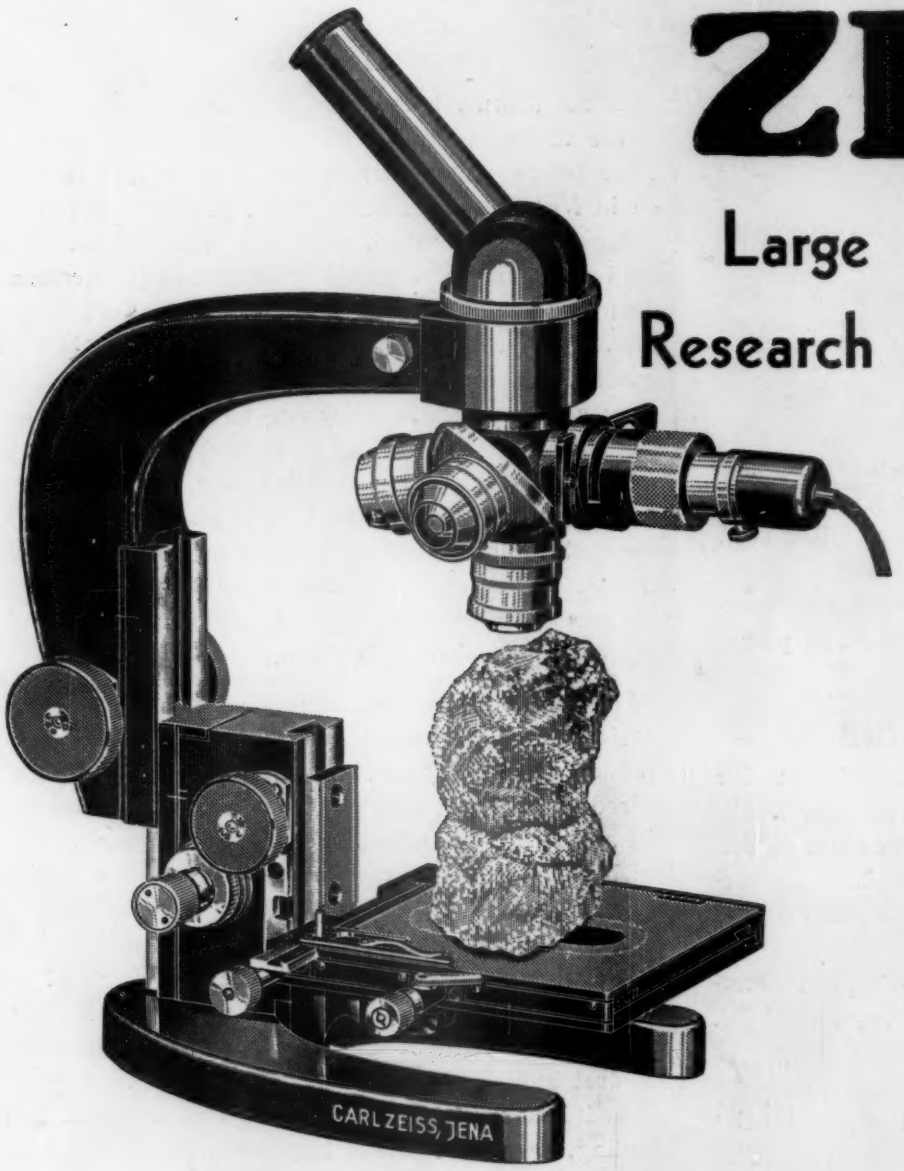

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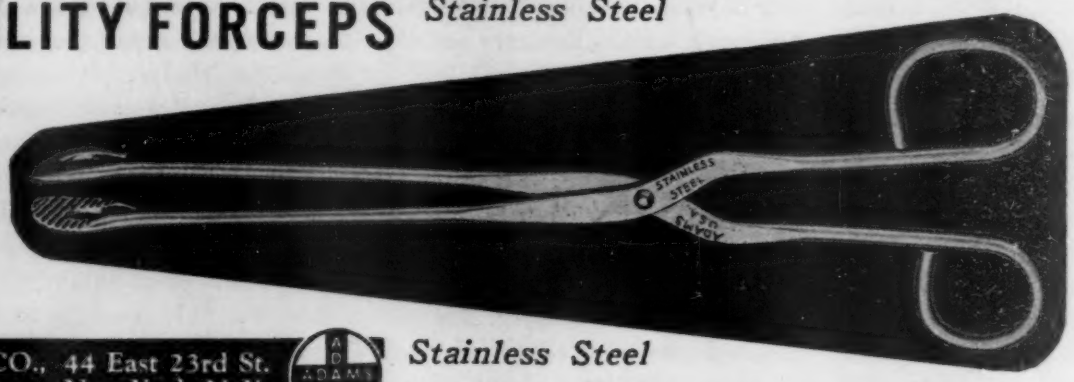

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SCIENCE NEWS

Science Service, Washington, D. C.

PRINCIPLES OF FOG FORMATION AND REMOVAL

ON the thirty-seventh anniversary of the Wright Brothers' first aerial flight at Kitty Hawk, at a meeting of the Institute of the Aeronautical Sciences held at Columbia University, Dr. Sverre Petterssen, professor of meteorology at the Massachusetts Institute of Technology, gave the fourth annual Wright Brothers Lecture, on "Recent Fog Investigations."

Fog may be removed, he said, in two ways. One is by actual physical removal of the fine drops from the air; the other by evaporating them. The latter may be done if enough heat is supplied, not only to evaporate the drops themselves, but also to raise the temperature of the surrounding air. Its relative humidity is lowered, and it can accommodate the extra water vapor produced from the drops. However, heating, over a large area, such as a harbor or airport, is impracticable because the heat must be supplied uniformly over the entire region. Another method which, he stated, has worked successfully has been to spray calcium chloride solution into the fog. This takes moisture out of the air, and reduces the humidity, so that the fog drops may evaporate at the prevailing temperature.

Among possible means for the physical removal of the drops, Dr. Petterssen cited the use of an intense sound, the waves of which would cause the drops to coalesce into larger drops, that would fall to the ground. However, "computations indicate that it yould not be practicable in natural fog." It has been used on a laboratory scale to precipitate smoke.

Hopes that infra-red rays, that is, light waves too long to be visible, could be used effectively to penetrate fog, were dashed. Belief that this was possible was due to the wrong use of a formula for light transmission through suspended particles. This only applies when the particles are about the same size as the wave-lengths of light. Since the fog particles are actually much bigger, about one six-hundredth of an inch in diameter, the light waves would have to be that size, about 500 times longer than they are, in order to produce an effect. However, waves as long as this would be absorbed by the gases in the atmosphere, and no advantage would be attained.

"There is no region of the radiant energy spectrum which will penetrate fog better than visible light. This result has been confirmed by direct measurement."

Dr. Petterssen pointed out that minute particles, each around a twenty-five thousandth of an inch in diameter, must ordinarily be present in the air as nuclei on which the water condenses to form the fog droplets. Ordinary raindrops are from a twenty-fifth to a sixth of an inch in diameter.

CHEMICALS DISSOLVED IN WATER

IDEAS of chemists that when a chemical is dissolved in water, both it and the water are unchanged were challenged at a meeting of the Chemical Society of Washington by Dr. David Harker, associate in chemistry at the Johns Hopkins University, as a result of experiments by him and other chemists. Dr. Harker showed how most inorganic compounds, that is, those which do not contain carbon, actually react chemically with water when dissolved. Aluminum chloride, for example, breaks up into atomic fragments or ions of aluminum and chlorine when in a water solution. The aluminum ions, he has found, unite with six molecules of water, which is hydrogen and oxygen, to form a large molecule of aluminum, hydrogen and oxygen. This is a strong acid. In the case of ordinary salt, sodium chloride, there is also a reaction, when dissolved, though it is less well defined.

When grease is dissolved in petroleum there is no change in either. The grease molecules mingle with the petroleum molecules, but are no different from what they are when separate. Chemists had supposed that solutions in water were of the same sort. Therefore in studying chemical reactions between such solutions the water was almost as much neglected as were the test tubes and beakers in which the reactions took place. This idea is wrong, and it is necessary to include the water in the reaction.

A NEW SYNTHETIC FIBER

GET acquainted with "prolon." It is a new name for what has been called "casein wool." Perhaps soon you will buy clothes, blankets, etc., made of it. This name is the latest addition to the family which now includes nylon, vinyon, rayon, celanese, and the other so-called "synthetic" fibers. It is suggested by F. C. Atwood, of the Atlantic Research Associates, in a paper in the current issue of *Industrial and Engineering Chemistry*.

Prolon is made from casein obtained from milk, soybean or other sources. Mr. Atwood objects to the name "casein wool" on several counts. The fiber itself is not casein, but a combination with other materials. Neither is it wool. "It happens to act like wool in some cases. It resembles silk and fur in other cases. Protein-base fibers are distinct entities by themselves and should be so considered."

Prolon fibers are being made in a number of foreign countries, and their use is increasing. Mr. Atwood expressed the opinion that improvement in quality will come with increased production.

"I know of a few imports of staple fiber within the year from Italy, Holland and Japan," writes Mr. Atwood. "The Italian product, lanital, was of fair quality and showed some improvement over the first imports. The Dutch material appeared to be superior to the Italian product. The Japanese fiber was of good appearance, but very poor in quality.

"The Japanese product is the only foreign material now available and is unsuitable for domestic textile uses, although attempts will probably be made by Japanese interests to import it. These products were all made from milk casein. Some Japanese soybean casein fiber is

expected soon, but the best information available indicates that the quality will be materially below that made from the milk casein.''

A NEW SULFA DRUG

(Copyright, 1940, by Science Service)

SPECTACULAR results with a new sulfa drug in fighting germs that threaten the lives of patients requiring operations for cancer or other diseases of the lower alimentary tract were announced by Dr. Warfield M. Firor, acting chief surgeon at the Johns Hopkins Hospital and acting professor of surgery at the Johns Hopkins Medical School, at the meeting at Hot Springs, Va., of the Southern Surgical Association.

The new sulfa drug is sulfanilylguanidine. This is the first report of its use on patients. Tests of it on animals, reported in September by Dr. E. K. Marshall of the Johns Hopkins Medical School, showed that it might prove effective in fighting such intestinal tract diseases as bacillary dysentery and typhoid fever. These tests showed that the new drug was fairly soluble in water, but that, unlike other of the sulfa drugs, it is very poorly absorbed from the digestive tract. This means that almost all of it stays in the lower alimentary canal. This lower end of the digestive tract always has germs in it. So long as they remain in the alimentary canal, most of these germs normally present do no harm. When, however, the surgeon must open the canal to remove a cancer or for other reasons, the germs have a chance to get out into other parts of the abdomen and cause serious, frequently fatal infection.

Dr. Firor reported that giving patients the drug before operation frees the alimentary canal of germs. In every case so far the wounds have healed without infection. Every patient has survived the operation, although mortality in operations of this type at the very best hospitals has been as high as 10 per cent. or 15 per cent.

Dr. Firor stated that the fall in number of germs in the alimentary canal when sulfanilylguanidine is used is ''phenomenal.'' In one case the bacterial count dropped from 17,000,000 to 10,000. The reduction in number of bacteria was not so striking in all cases, but has been sufficient to enable the surgeon to perform a successful operation without infection. Further advantage of sulfanilylguanidine is that it is less toxic than any of the other sulfa drugs and it is given by mouth.

Sulfanilylguanidine, under the federal food and drug restrictions, has not yet been released for general sale, but is being distributed to a number of surgeons for further study of its effects. It is made by the Calco Chemical Company.

On the medical side, sulfanilylguanidine has been used with gratifying results in treatment of acute bacillary dysentery. Dr. Marshall expects to report soon on trials of the drug now being made in Puerto Rico, where dysentery occurs the year round. He believes, however, that the number of cases treated so far is too small to make any claim that the new drug is a cure for bacillary dysentery.—JANE STAFFORD.

DRUG ADDICTION

NEW hope for the conquest of drug addiction appears in a report from Dr. Donald Slaughter, Dr. J. Charles Parsons and Dr. H. Deane Munal, of Dallas, Texas, to the *Journal* of the American Medical Association.

The clue to a possible way of conquering drug addiction came from a study of a new method of using morphine to relieve pain in patients suffering severe injuries, heart disease or undergoing surgical operations. Pain could be relieved with one-half the usual dose of morphine in most cases when another drug, prostigmine methylsulfate, was given with the morphine. Use of morphine for relief of pain during serious illness is said to be frequently followed by addiction to the drug. Of a series of 1,276 morphine addicts, 325 attributed their addiction to medical use of the drug.

One man, an ambulance driver, who became addicted to morphine originally through such medical use of it, came to the Robert B. Greene Memorial Hospital in San Antonio for a serious operation. Following the operation he was given morphine in the dosage which he had been taking before the operation. Two days later, he was able to get along on about half this dose when given with prostigmine methylsulfate. The dose of morphine was further reduced in this way to a third of the original size of dose without the patient's knowing that there had been any change. By the sixth week the patient was getting about a quarter the amount of morphine in a single dose and skipping every other dose without ill effects.

''During the time prostigmine methylsulfate was used with the morphine, no withdrawal symptoms were noted.'' It is suggested that this case ''lends encouragement to the use of this drug in similar cases,'' and that they are investigating further the angle of tolerance and addiction.

CUNNINGHAM'S COMET

DR. FLETCHER WATSON, of the Harvard College Observatory, reported to a recent meeting of the American Academy of Arts and Sciences that Cunningham's comet, now coming into view in the western evening sky, may sweep the earth with its tail next month.

He explained it this way: ''On January 13 the comet will very nearly pass between the earth and the sun. Since the tail of a comet extends almost directly away from the sun, the tail of this comet will stream out in the general direction of the earth. Whether or not the earth will pass through the tail is still in dispute; first the comet must develop a tail nearly 60,000,000 miles long. Even then there is no reason for us to become excited for comet tails contain very little material and no effects of a possible collision can be apparent. In 1910 the earth passed through the tail of Halley's comet only a few million miles from the comet and nothing came of it.''

So far, he stated, the tail is much shorter, less than a million miles in length. However, the greatest changes and development of a tail will come as it approaches the sun. On January 16, he said, it will be closest the sun, at a distance of 34,000,000 miles, less than the distance of Mercury.

Harvard astronomers, Dr. Watson told his audience, are making a special effort to obtain a complete sequence of observations of the appearance of the comet, and the character of its light. At the present time the light and other radiations are mostly from molecules of carbon and

nitrogen. "In the middle of December, when the tail may begin to take shape, sodium will probably appear and other radiations may be detected as the comet nears the sun."

Cunningham's comet has been steadily brightening since its discovery in September. It can now be seen with the aid of binoculars near the star Albireo, in the constellation of Cygnus. The brilliant moon now offers some interference with the view, but by Christmas eve the moon will be out of the way. Then the comet, it is expected, will be seen easily with the naked eye near the star Altair, in the constellation of Aquila, the eagle, which is observed in the western sky soon after sunset.

PREPARATIONS IN SOVIET RUSSIA FOR THE OBSERVATION OF THE ECLIPSE NEXT SEPTEMBER

WHEN the tip of the moon's shadow next strokes the earth, along a path crossing Siberia and China on September 21, 1941, some two hundred investigators in thirty groups at sixteen different points in Russian territory, will be making observations of the total eclipse of the sun, according to a dispatch received from Tass, the Soviet news agency.

The Soviet Academy of Sciences has set up a commission under the chairmanship of V. Fesenko, to take charge of preparations. A book in Russian and English is shortly to be published giving details of the planned observations, and a discussion of the weather probabilities in the various locations.

"The zone from which the total eclipse will be observable," Dr. Fesenko is quoted as saying, "stretches from the shores of the Caspian Sea across that sea and the Aral Sea, through the cities of Kzyl-Orda and Alma-Ata, and then on to Chinese territory. The maximum duration of the total phase of the eclipse will be about 2½ minutes.

"The mountains of Kazakhstan through which the zone of total eclipse passes offer excellent points of observation."

Among the subjects which will be studied are the Einstein theory of relativity, the sun's corona, its innermost atmospheric layer, the chromosphere, the sudden explosions in the sun that seem to cause electrical and magnetic disturbances on earth, and the zodiacal light, a glowing band sometimes observed near the sun.

To supplement the ground observations some astronomers will ascend high above the earth in airplanes and stratosphere balloons. These should be especially useful if clouds hamper the work of the ground parties.

ITEMS

U. S. LYONS, astronomer of the United States Naval Observatory, has reported to Science Service that a new group of spots on the sun passed across the exact center of the sun's face on Sunday, December 8. Radio disturbances and displays of the northern lights are sometimes associated with them. These spots, which included ten separate condensations, were on the solar equator. This is a rare position for spots at any time, especially so long after the maximum of the 11-year spot cycle in early 1937. At the time this group crossed the center of the disc, there were five others visible. A total number of 36 spots could be seen, which covered an area of 17.5 square degrees.

A MASS of special electrical equipment occupying the space of a two-story house, including transformers, rectifiers, capacitators, etc., will form the unique "finishing school" to prepare the electricity needed to run the new 4900-ton cyclotron of the University of California. This huge "atom-smasher" is now under construction as a result of a grant of $1,150,000 from the Rockefeller Foundation, supplemented with $250,000 from other sources. Its electrical apparatus, which will take more than a year to construct, was designed by Dr. Edwin McMillan, of the Radiation Laboratory. It has been ordered from the General Electric Company. Dr. E. O. Lawrence, inventor of the cyclotron, in charge of the laboratory, said that 2,500,000 watts of electrical power will be needed to run the machine. Power supplied from the lines is three-phase, alternating current, but it will be changed to single-phase direct current before it is fed into the cyclotron. The new equipment will be finished in three years. It will be capable of accelerating charged atoms to 100,000,000 electron volts energy.

A YARD-LONG, black creature recently sent to the Smithsonian Institution as a fossil snake turns out to be neither fossil nor snake, but something more interesting still. It is an Amphiuma, an almost limbless amphibian related to the salamanders, but so rare that years may go by without so much as a single one being added to museum collections. Amphiuma is commonly mistaken for a snake, despite its lack of scales, because its legs have become so degenerate that they are practically invisible. Its eyes also are extremely small, and probably do the animal very little good. It commonly lives in muddy water, coming to the surface to breathe at intervals, and feeding on fish eggs and aquatic larvae. The females come ashore to lay their eggs, around which they remain coiled until they are hatched. The present specimen was found under about 15 feet of mud in the Everglades. It probably was trapped by a slide of muck during the dredging work, and thus killed.

A NEW blood test which will aid in the diagnosis of jaundice and also will predict the course of the disorder has been devised by Dr. J. L. Irvin and Dr. C. G. Johnston, of the College of Medicine of Wayne University, and Dr. E. A. Sharp, of Parke, Davis and Company and the Harper Hospital, Detroit. The test might tell, for example, whether the jaundice is due to liver disease or to one, and which one, of several kinds of anemia. The test, reported to the Central Society for Clinical Research, is said to give for the first time a method of making dependable quantitative determinations of the bile acids in the blood. The amount of these, the test shows, is about one tenth to one twentieth greater in anemias characterized by destruction of red blood cells than the amount needed to destroy normal red blood cells in the test tube. Whether this concentration of bile acids in the blood is the cause of the red-cell destruction is the next point to be determined.

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE IN 1940

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MATHEMATICS

IN the so-called four-color problem it was shown that any map on a sphere containing 35 or fewer regions can be colored with four colors; this is an extension of 4 beyond the number 31 reported in 1938.

It was shown that a square can be cut up into a finite number of smaller squares no two of which are of the same size.

A computing machine was developed for multiplying and dividing complex numbers, constructed largely of telephone relays and switches.

An automatic machine to play the mathematical game of Nim was constructed and exhibited.

The fundamental algebraic notion of a group under an operation of multiplication was widened in various ways, notably in order to include cases where the operation acts on more than two elements.

New results were obtained in the theory of fields, particularly modular and p-adic number fields.

Some of the algebraic methods which had been applied previously to the difficult problem of smoothing-out the singular points on two-dimensional surfaces were successfully extended to higher-dimensional surfaces.

New and definitive contributions to lattice theory appeared, emphasizing the very wide applications of lattices to the combinations of given algebraic systems.

In mathematical statistics, the problem of lengths of runs was extensively investigated.

Considerable advance was made in the theory of integral equations, particularly for a type of integral equation encountered in many problems of dynamics and quantum mechanics.

A new notion of curvature was advanced, a strictly local property of a space, which can be integrated over the whole space to give a result closely connected with the topological structure of the space.

CHEMISTRY AND PHYSICS

ATOMIC power, long a dream of science, was brought a step nearer with the actual isolation of minute quantities of Uranium 235, the form, or isotope, of this metal which when once started disintegrating by bombardment with atomic fragments, continues the process with the liberation of tremendous amounts of energy.

Produced commercially for the first time in the United States, a microscope which sees with electrons instead of light, opened many new fields in medical, physical and industrial research.

Experiments with the klystron tube using large amounts of power at ultra-high frequencies were successful in transmitting wireless power a distance of many feet.

Measurements of the energies binding together the protons and neutrons of which the hearts of atoms are built were accomplished by bombarding carbon and paraffin with high energy neutrons, the atom-smashing bullets.

The total eclipse of the sun, visible in Brazil, was found to have an effect on the cosmic rays.

The mesotrons, an important part of the cosmic rays reaching the earth and which are formed high in the air when the atmospheric atoms are struck by other rays from outer space, were found to have a short life, a few millionths of a second.

Neutrons, atomic particles having no electrical charge, were found to be associated with the cosmic radiation, and experiments were started to measure them at various latitudes to correlate them with other cosmic rays.

A photograph was obtained showing a mesotron, one of the heavy weight kind of electrons that occur in cosmic rays, disintegrating into an ordinary electron, thus confirming a prediction.

A new theory of relativity was devised which makes space flat instead of curved and explains puzzling experiments which seemed to show a drift of space through the "ether."

Radio waves transmitted by atoms were discovered and measured, with them such subtle properties of atoms and molecules as the magnetism of their component parts can be measured a hundred times more accurately than by any previous method.

Pressures as high as 3,500,000 pounds per square inch were obtained in laboratory experiments, to duplicate the pressures far underground.

The natural process by which glucose is converted in plants into starch was duplicated in the laboratory for the first time, pointing the way to synthesis of foods.

A method was discovered by which coal and oil can be made in the laboratory from plant carbohydrates, thus accomplishing in a few hours what has taken nature millions of years.

A new synthetic rubber was announced, and tires, made from another kind of synthetic rubber, were placed on the market.

A heavy isotope of sulfur, making up about four per cent. of ordinary sulfur, was isolated.

Elements heavier than uranium, formerly supposed to have the heaviest possible atoms, were obtained in the laboratory.

ASTRONOMY

FIVE comets were discovered, four were new ones, one the return of a periodic comet found in earlier years: Kulin, periodic Whipple, Cunningham, which has attained naked-eye visibility as the brightest comet since 1910, a new Whipple and Okabayasi.

By means of photographic observations of the effect it produced on two visible stars, an invisible companion was discovered to the double star system Zeta Aquarri.

The probable relationship between Encke's comet and meteors of the autumn Taurid shower was demonstrated.

Taking into consideration new measures of their dis-

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tances, the diameters of the largest known stars were recalculated, giving first place to Ras Algethi, in Hercules, with 690,000 miles, and demoting Antares, formerly supposed to be largest, to fourth place.

Four exploding stars, of the type known as "supernovae," were found in distant star systems.

Fifteen "white dwarfs," stars of extreme density, many tons to the cubic inch, were located.

Theories that the planetary system was formed by condensation of a great gaseous mass pulled out of the sun were shown to be untenable by a demonstration that such a mass would not condense, but would dissipate.

The cosmic dust which permeates interstellar space was found to be very unevenly distributed.

The world's highest astronomical observatory was established at Fremont Pass, Colo., an altitude of 11,318 feet, as a branch of the Harvard College Observatory for study of the sun's corona.

A reflecting telescope with a five-foot diameter mirror was placed in operation at the Argentine National Observatory.

A telescope attachment known as the "quartz monochromator" made possible a new way of observing prominences of the sun.

On April 7 an annular eclipse of the sun was visible in the southern United States and observations were made of the infra-red light from the sun's rim as the moon covered its center.

The path of totality of a solar eclipse on Oct. 1 passed over Brazil and South Africa, but, in the former, cloudy weather hampered many of the observations.

A rare transit of the planet Mercury across the face of the sun, last until 1953, occurred on November 11, and was widely observed.

The five naked-eye planets, Mercury, Venus, Mars, Jupiter and Saturn, were lined up in the western sky in a rare formation.

Earth Sciences

A SEVERE earthquake caused widespread death and destruction in Rumania on November 10; during the year there were 36 other quakes sufficiently severe to register themselves on distant seismographs.

The U. S. Weather Bureau initiated the making and broadcasting of five-day forecasts, based largely on air mass analyses.

U. S. Coast Guard cutters served as "weather ships," taking observations at sea to replace those formerly sent by merchant ships now silencing their radios.

The most severe magnetic storm since 1921 occurred on Easter Sunday, seriously interfering with wire and radio communications.

The nearly complete fossil skeleton of a Uintatherium, giant six-horned beast of 30 million years ago, was discovered in Wyoming.

The practically complete skeleton of a young elephant of Pliocene date was unearthed in Siberia.

Wormholes in fossil wood, a great geological rarity, were found in a petrified forest in China.

Great Smoky Mountains National Park was dedicated by President Roosevelt on Labor Day.

Biological Sciences

A HITHERTO undescribed large mammal, the kouprey or wild ox of Indo-China, was introduced to science; it is the first "new" mammal of major size to be described since the discovery of the okapi more than a generation ago.

One-celled green water plants were discovered to be able to absorb carbon dioxide and form food in the dark, also to make use of hydrogen as an energy source.

Green plants were discovered to be able to manufacture a bacteriophage to protect themselves against germ diseases, and molds were also found to produce a bacteria-killing substance.

Plant disease viruses, hitherto known only as parasites, were found to be able to feed on non-living materials.

Plants recovering from certain virus diseases were found to have acquired immunity.

Discovery of a highly fatal disease of Japanese beetle larvae gave hope of establishing biological control of this pest.

A new kind of chlorophyll was found in a variety of jimsonweed artificially "evolved" by x-ray bombardment.

Close observation of developing embryos in eggs was made possible by invention of a technique involving making of windows in ends of eggshells.

Green plants give off very faint flashes of red light while making food, it was discovered.

Ability of cockroaches to get along without vitamin A, supposed to be essential to all life, was discovered.

White pines resistant to blister rust were discovered in Wisconsin.

It was discovered that the value of rabies vaccine for dogs could be tested on mice.

Barro Colorado island in Gatun lake became a U. S. government project, where scientists may study tropical animals and plants under natural wilderness conditions.

A fatal epidemic among sponges in Florida and West Indian waters appeared in the spring, and abated in autumn after killing a large percentage of the most valuable sponges.

Sulfanilamide was found to be a stimulant for formation of roots on plant cuttings.

The chromosome number in the chimpanzee was found to be 48, the same as in man.

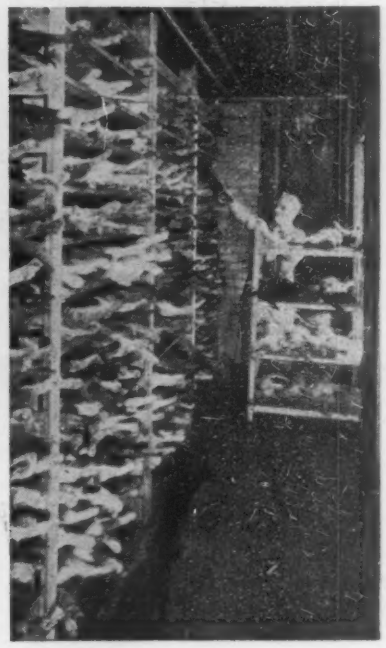
A short-legged coyote, built on dachshund lines, was found in California.

Anthropology and Archeology

NAVAJO INDIANS saw their language put into alphabetic writing for the first time. New equipment made it possible to play safely thousands of frail cylinder records on which scientists have preserved folk music and primitive songs.

An archeologist of today buried the Time Capsule at the New York World's Fair, packed with exhibits and records of our civilization for the archeologists of 6939 A.D.

War in Europe endangered such irreplaceable antiquities as the Rosetta Stone (London), the Elgin Marbles (London), bust of Queen Nefertiti (Berlin), and temples and monuments in Athens and many other cities.



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Discovery in Java of a fourth skull of Pithecanthropus provided scientists with the first chance to study a grown male skull of this ancient pre-human genus.

The undamaged silver coffin and golden ornaments of Pharaoh Psousennes I, found in the Egyptian Delta, were pronounced in some respects as important a find as the Tutankhamen tomb.

The 1940 census showed the population of continental United States has increased 7.2 per cent. in 10 years to a total of 131,669,275; while preliminary figures based on the census returns give the entire United States with its territories and possessions a population of 150,621,720.

The Coronado Cuarto-Centennial celebrated in the Southwest stimulated historic and archeological study of their route.

Three successive eras of Folsom Man's career in early America were traced by finding a stratified corner of the Lindenmeier site in Colorado.

Excavating the oldest town yet found in Arctic Alaska, an expedition traced well-planned streets with more than 600 homes, and unearthed burials stored with art and cultural objects perhaps 2,000 or 3,000 years old.

An old Panama graveyard revealed the burial of an Indian official in gold regalia with sacrificed slaves or captives.

Five colossal stone heads and other remarkable art objects unearthed in Tabasco Province, Mexico, added to knowledge of the Olmec Indian civilization which preceded the Toltecs.

PSYCHIATRY AND PSYCHOLOGY

ELECTRIC shock therapy, a method of treating mental disease by passing an electric current directly through the brain, was introduced in the United States.

The ink blot test, familiar as a measure of imagination, was used successfully to predict which mental patients would respond to insulin shock treatment, and to distinguish neurotics from those with uncomplicated mental disease.

Actual measurement of how an individual behaves when approaching a nervous breakdown was made possible by a new technique developed in experiments with animals.

Brain waves were put to practical use in the rejection of would-be pilots with brain waves believed characteristic of epilepsy.

Airsickness, which can be produced in the laboratory by mild electric shock through the ears, can also be produced by "conditioning," it was found when simultaneous ringing of a bell with the shock taught individuals to sway or fall over when later they heard the bell alone.

Theories of learning were affected by discovery that an individual conditioned in deep hypnotic sleep by smelling creosote during the ringing of a bell will afterwards in waking state "smell" creosote whenever he hears that bell, and without any remembered associations.

All individuals, regardless of age, sex, or state of mind, are equally sensitive to pain, it was discovered by a new technique which opens the door to new laboratory experiments on the effects of pain-relieving drugs.

Hunger does not exist as a single manifestation, it was found; instead there are at least 10 specific hungers, for protein, fat, carbohydrate, water, oxygen, salt, phosphorus, sodium, calcium and the vitamin B complex.

The span of visual attention, that is the number of dots that can be seen in a fraction of a second, was shown to depend on the exposure time and the light intensity; the shorter the exposure time, the greater is the light intensity required.

The excitability of the visual receptor was found to be cyclic, even with constant stimulation; at the end of the cycle the receptor discharges, and thereafter requires recovery during another cycle before it discharges again.

When a uniform area of the eye is stimulated by light, it was found that there is greater nervous excitation near the center of the area than at the edges.

Sounds can be heard as coming from different directions, not only horizontally as has long been known, but also vertically, it was found, provided you turn your head while listening.

Color vision and ability to distinguish small differences of color were observed to be equally developed in man and in chimpanzee, though man does somewhat better with the reds.

Five leading psychological organizations appointed representatives to cooperate with the National Research Council in making the services of psychologists available to the defense program.

A number of organizations became concerned with the psychological factors involved in morale; a conference of 25 psychologists discussed and reached an agreement concerning factors involved.

Public opinion polls reduced their average error between 2 and 3 per cent. in predicting the outcome of the November elections, thus establishing themselves with some security as perhaps the first technique in the social sciences to achieve scientific prediction.

ENGINEERING AND TECHNOLOGY

IT was found possible to predict three months in advance the best frequencies to use for dependable radio transmission. Recorded music of orchestra, organ and choir was reproduced with its original tonal range and spatial sense, and a tenfold greater range of loudness.

Coastal-harbor radio stations opened at Wilmington, Charleston, Tampa and Galveston make radio telephone service available to small watercraft along the entire ocean and Gulf coast of the United States.

Direct radio telephone channels from the United States were established during 1940 to LaPaz, Berlin and Madrid.

The Federal Communications Commission permitted the high-fidelity frequency modulated radio to go into use, but held up authorization of commercial television until there was more agreement concerning standards.

Television by radio in natural color, using a single channel, was accomplished.

A television program covering the Republican convention in Philadelphia was transmitted over the coaxial telephone cable to New York and then broadcast by radio.

New dustless and sliverless copper was developed to reduce short circuits in electric wiring.

(*To be concluded*)

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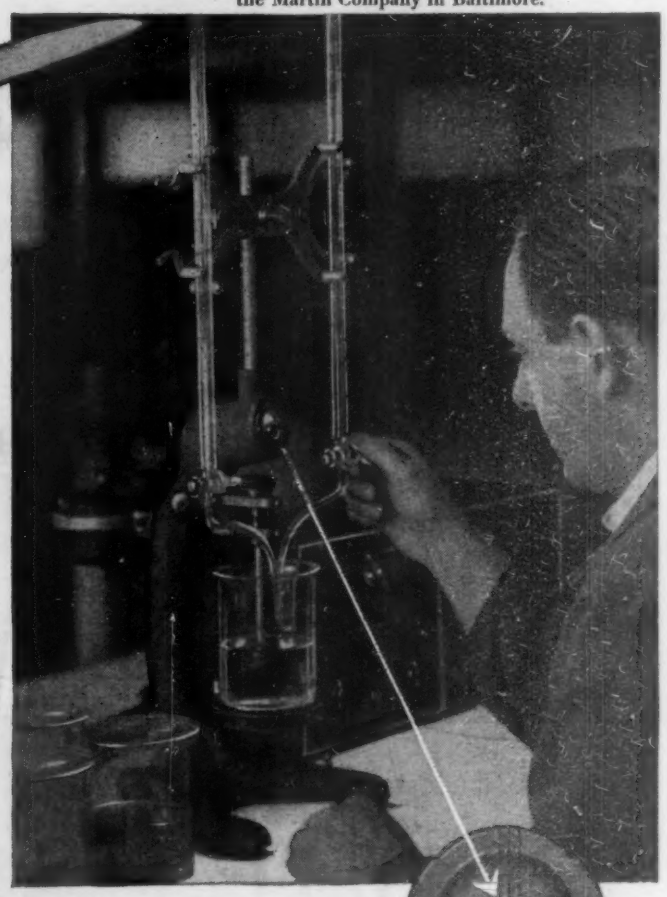

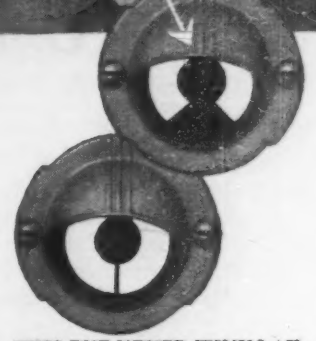

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205–223 Third Avenue New York

Science: published weekly by The Science Press, Lancaster, Pa.
Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

DEPOSITION OF RADIOACTIVE IODINE IN HUMAN THYROID TISSUE

by

Joseph G. Hamilton, Mayo H. Soley, and Karl B. Eichorn

First announcement of the discovery that "the tiny amount of iodine which is taken into the body with food is amazingly concentrated in a few cells in the thyroid gland, but not in the storage material which the gland uses to make its secretion." A new method of picture reproduction is also used for the first time, as the radioactive iodine was allowed to make its own.

University of California Publications in Pharmacology

Volume I, No. 28, pp. 339–368, plates 6–14
Paper, 50¢, 1940

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES

Handbook of Microscopic Characteristics of Tissues and Organs

By Karl A. Stiles, M.S., Ph.D., Prof. of Zoology, Chairman of the Division of Natural Sciences, Coe College.

Illustrated, 148 Pages $1.50

Students will find this book especially valuable in their identification studies. The fundamental histological characteristics of tissues and organs are presented in outline form in a manner easily and quickly grasped.

Introduction and Guide to The Study of Histology

By Avery E. Lambert, Ph.D., Prof. of Histology, School of Medicine, State Univ. of Iowa

185 Illustrations, 542 Pages $5.00

A foundation course in histology, this successful book clearly presents the essential knowledge of the various structures, organs and systems of the human body. It includes comprehensive and intelligible directions for laboratory study.

THE BLAKISTON COMPANY, Philadelphia

LEA & FEBIGER PUBLICATIONS

On exhibit in the Science Library during the 1940 Meeting in Philadelphia.

Zoological Sciences

Craig and Faust's Clinical Parasitology
Second edition $8.50

Kendall's Microscopic Anatomy of the Vertebrates
Second edition 3.75

Lucas' Elements of Human Physiology 4.50

Thienes' Clinical Toxicology 3.50

Medical Sciences

Bunting and Hill's Oral Pathology
Second edition 6.50

Cushny's Pharmacology and Therapeutics
Twelfth edition 6.50

Haden's Principles of Hematology
Second edition 4.50

Rony on Obesity and Leanness 3.75

LEA & FEBIGER
WASHINGTON SQUARE PHILADELPHIA, PA.

PREVIEW OF THE ANNUAL EXHIBITION

of the American Association for the Advancement of Science, Convention Hall, Philadelphia, Pa., December 27 to December 31

The exhibition of the American Association for the Advancement of Science will this year be held at the Convention Hall, Philadelphia, from December 27 to 31.

We wish to express our appreciation for the cooperation that we have received from the exhibitors who have helped to maintain the high standards of the exhibition. Some institutions and concerns who have recently decided to take part in the exhibition have not had time to send descriptive material for publication in this issue of *Science*. A brief description of exhibits follows.

DORIS LEISEN,
Director of Exhibits

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Booth Nos. F, G

An exhibit depicting Association work, including the affiliated and cooperating agencies, a display of books and publications, photographs and charts in connection with Association work and with the future meetings, particularly Dallas. There is also an exhibition of motion pictures of the people of Dallas, their work and play, their institutions and business buildings, their streets and parks, for it is at Dallas, Texas, that members of the American Association will convene next year.

AMERICAN GEOPHYSICAL UNION

Booth No. 407

(Dr. Harlan T. Stetson and Dr. W. T. Thom, Jr.)

This exhibit depicts methods and results of geophysical explorations of the sky above and the earth beneath, the effect of solar disturbances on the ionization of the upper atmosphere auroras and the propagation of radio waves. The variation in travel time of time signals with geographic latitude and a three dimensional model of basement complex of underlying continental United States from the latest geophysical surveys are displayed. This exhibit is representative of the work of special committees on cosmic terrestrial relationships and of explorations of continental and ocean basins.

AMERICAN MUSEUM OF HEALTH

New York

Booth Nos. 134, A

Our Population: The inherent capacity for growth of the population is actually determined by the proportion of daughters and granddaughters arising from the original batch of 100 newborn girls. According to conditions prevailing in 1800, a batch of 100 newborn girls would have had 223 daughters and 497 granddaughters. At that time an average family comprised about 7 or 8 children. Since then, families have greatly shrunk, and according to current conditions 100 newborn girls will have about 97 daughters and 94 granddaughters. In spite of this, our birth rate temporarily still exceeds the death rate. A group of exhibits explains how this is made possible by a temporarily large proportion of women in the childbearing ages. Such an excess exists at the present time, but will gradually disappear.

BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE

Booth Nos. 106, 108

This exhibit illustrates the high altitude cosmic ray measurements, together with directional and latitude measurements of cosmic radiation, made by T. H. Johnson and his collaborators. It includes neutron counters in operation together with a graphic summary of S. A. Korff's measurements of neutron intensity at high altitudes and stereoscopic pictures of the apparatus used by W. F. G. Swann and W. E. Ramsey in measurements of shower production by mesotrons will be shown. An apparatus designed and constructed by Professor Victor Hess for measurements of seasonal cosmic ray variations is also displayed.

BAUSCH AND LOMB OPTICAL COMPANY

Rochester, N. Y.

Booth Nos. 329, 331

Featured in a complete display of optical equipment are the new laboratory microscopes and a precision refractometer. Advancements in these instruments merit attention. For those interested in color photography, there is a $2'' \times 2''$ slide projector which will give brilliance and detail to slides. Other items in operation are research and stereoscopic wide-field microscopes, microscope accessories, microtomes, micro-projectors, Balopticons, photomicrographic equipment and optical measuring instruments. Messrs. J. I. Wexlin, M. Seelinger, G. H. Leffler and E. H. Anthes are greeting visitors.

JAMES G. BIDDLE COMPANY

Philadelphia

Booth No. 416

This exhibit includes the Jagabi "Lubritact" rheostats, "Pointolite" lamps, chronometric and centrifugal speed-measuring instruments, "Frahm" vibrating-reed tachometers and frequency meters. There are also on display the "Dionic" water tester and the "Megger" direct-reading resistance measuring instruments.

BIOLOGICAL ABSTRACTS

University of Pennsylvania

Booth No. 103

A cooperative, non-profit enterprise published by biologists themselves to provide a means for keeping abreast of a rapidly growing and increasingly diversified biological literature. Abstracting regularly about 1,300 journals, including many foreign publications, *Biological Abstracts* is the only abstracting service in the world which covers the entire field of biology. It is now published in five sections as well as the complete edition. A comprehensive index is published as a separate issue with each volume. Dr. John E. Flynn, editor-in-chief, and others are in attendance to welcome visitors and furnish additional information.

THE BLAKISTON COMPANY

Philadelphia

Booth No. 325

The exhibit includes a complete collection of textbooks and references in the sciences. Among the books published in 1940 are: Osgood, *Laboratory Diagnosis*—3d ed.; Davies, *Fundamentals of Physical Chemistry*—2nd ed.; Bundy, *Anatomy and Physiology*—7th ed.; Waldbauer, *Theoretical Quantitative Analysis;* Duff and Plimpton, *Elements of Electro-Magnetic Theory;* Stiles, *Handbook of Microscopic Characteristics of Tissues and Organs;* Wertheim, *Laboratory Guide for Organic Chemistry*—2nd ed. Advance material on the following new books is available: Foley, *College Physics*—3rd ed.; Meredith, *Hygiene*—3rd ed.; Hylander and Stanley, *Plants and Man;* Piston, *Meteorology*—2nd ed.; Colin, *Elements of Genetics.* Representatives in attendance are: Mr. Robert F. Bowman, Mr. J. Brooks Stewart, Mr. E. R. Stetson, Mr. Harold T. Turner.

BOYCE THOMPSON INSTITUTE FOR PLANT RESEARCH, INC.

Yonkers, N. Y.

Booth Nos. 403, 405

Problems under investigation are demonstrated by living plant material, kodaslides, animated and stationary graphs. These demonstrations include treatment of cut fruit to prevent discoloration; prevention of sprouting of buds, breaking of dormancy and substances formed in tissues from introduced chemicals; development of color in potato chips; effect of growth substances on plants; relative solubility of different growth substances; methods of seed storage and germination and quick vitality test; storage of pollen; forcing flower buds in Gardenia; a hybrid lily; drug plants as sources of insecticides; laboratory methods of testing fungicides; the use of the serum reactions for diagnosis and classification of plant viruses; an example of field plot design. Suggestions for lecture and laboratory demonstrations may result from the exhibits and through discussion with staff members in attendance.

CARNEGIE INSTITUTION OF WASHINGTON

Booth Nos. H, I

(Dr. Ralph W. Chaney)

Have Continents Migrated? The exhibit comprises a panel showing relationships of Tertiary and modern plants, a map showing distribution of modern forests and isotherms, and a map showing distribution of Eocene fossil floras, with isoflors. Comparison of modern forests with those of the Tertiary period shows that many similar trees have survived through the intervening sixty million years. Living to-day in regions more southerly, their distribution seems always to have been controlled by temperature, for lines connecting Eocene fossil localities have a marked latitudinal trend. These lines, known as isoflors, further resemble modern isotherms in turning north across the oceans and southward over the continents, indicating modifying influences of oceans and ocean currents like those of to-day. Forests under compulsion of climatic change, rather than the continents on which they lived, appear to have been the wanderers during later chapters of earth history.

Department of Genetics

Cold Spring Harbor, N. Y.

Booth Nos. J, 435

This is a demonstration of the methods used in correlating certain genes of Drosophila with specific bands of the salivary chromosomes. This correlation makes it possible to determine whether or not a genetic change is connected with a microscopically detectable alteration in the band representing the affected locus. The exhibit is planned to include a short motion picture on chromosome behavior, several photographs, transparencies, charts, and working models illustrating various types of mutations and chromosomal alterations. It is demonstrated by M. Demerec, B. P. Kaufmann, Eileen Sutton, Maydelle Bishop and Jean Lane.

CENTRAL SCIENTIFIC COMPANY

Chicago

Booth Nos. 317, 319

The exhibit of the Central Scientific Company features new developments in the laboratory and research field. Among some of the new developments on display, some in actual operation, are a simple interferometer for measuring wavelengths which employs the principle of the wedge, a new simplified student laboratory spectrometer, a new idea in low cost projection meters, Cenco-Sheard "Spectrophotelometer," a new simplified stroboscope, and several other new devices of interest in the fields of physics, chemistry and biology.

CINCHONA PRODUCTS INSTITUTE, INC.

New York

Booth No. 131

Colored reproductions of malaria plasmodia and publications on the treatment of malaria with quinine are the main features of the exhibit. Thin smear details of *Plasmodium vivax* (benign tertian), *P. malariae* (quar-

tan) and *P. falciparum* (subtertian) are shown in colored enlargements. The originals were prepared under the direction of Dr. C. W. F. Winckel, of Amsterdam, and are of interest to clinicians, diagnosticians and epidemiologists. Reprints of the originals, with a detailed key to them, are available. Mr. J. van As is in charge.

CLAY-ADAMS COMPANY, INC.
New York

Booth No. 121

This exhibit includes a number of botanical and zoological models as well as anatomical material, particularly models which have been recognized for their completeness of detail, teaching value and durability. Laboratory items including centrifuges, the Adams Compact Balance, slide trays, slide cabinets, slide boxes, and other equipment are featured.

COMMITTEE ON EDUCATION AND PARTICIPATION IN SCIENCE
Philadelphia

Booth Nos. 122, 124

Amateur Scientists at Work is the theme of this exhibit, which consists of enlarged photographs, posters, descriptive labels and objects demonstrating the volunteer research projects for amateur scientists in botany, climatology, physics and zoology. Present are persons studying organisms under the microscope, preparing specimens and engaging in other activities, demonstrating the work of the forty laymen organizations affiliated in the Philadelphia Council of Amateur Scientists. The committee's work is carried on by a grant from the Carnegie Corporation of New York and under the supervision of the American Philosophical Society. Literature is available.

DENOYER-GEPPERT COMPANY
Chicago

Booth No. 218

Come and see the many new accurate dissectible models for teaching anatomy, health, biology, botany and zoology. Let us demonstrate Chip-proof construction, our new method of coating models with a layer of metal that adheres to the surface and greatly increases their durability. Also inspect our New Plastic Corrosion Preparations and examine our latex injected specimens. We are also displaying charts, skeletons and museum preparations. In attendance are M. C. Stowe and C. E. Brooke.

EASTMAN KODAK COMPANY
Rochester, N. Y.

Booth Nos. 305, 307

This exhibit shows a variety of scientific photographs that present a cross section of the kinds of pictures likely to be made by scientists and research workers. Representatives in the booth are pleased to discuss the photographic procedures involved and demonstrate the actual procedure insofar as possible. A comprehensive collection of equipment for use in scientific photography is displayed. Mr. H. J. Christy and Mr. A. L. Ter-Louw represent Eastman Kodak Company at this exhibit.

FEDERAL WORKS AGENCY
Washington, D. C.

Booth No. 123

The theme of this exhibit is "WPA Frees the Research Man from Routine." The display shows how the WPA project is used to relieve professional people of numerous non-professional details which slow up research work and scientific progress. It is keyed to the needs of scientists who have research to undertake but lack the funds necessary to hire the clerical and semi-technical assistance needed to free them for the major work at hand.

FORD MOTOR COMPANY
Johansson Division
Dearborn, Michigan

Booth No. 327

The Johansson Gage Block exhibit will consist of various sets of Johansson Gage Blocks and Accessories. Several demonstrations of how these accurate gaging tools may be used will be on display as well as a series of colored slides in an Automatic Balopticon. The exhibit also includes six interesting paintings showing the history of measurement of length. The exhibit will be in charge of Mr. O. E. Green, assisted by Mr. O. L. Kelley.

GENERAL MOTORS CORPORATION
Research Laboratories Division
Detroit, Mich.

Booth No. 418

This exhibit includes the *Magnetic Pendulum*, demonstrating an electrical phenomenon not clearly understood which provides the motivating force to operate the pendulum; the *Hydra-matic Transmission*, an example of applied physics resulting in fully automatic gear ratio selection, clutching and eliminating the clutch pedal and all manual gear shifting operations; the *Fluid Coupling Principal*, illustrating the principle of power transmission by a fluid coupling as used in the hydra-matic unit. Mr. J. Z. Feris is in charge.

GRADWOHL SCHOOL OF LABORATORY TECHNIQUE
St. Louis, Mo.

Booth No. 222

The exhibit shows up-to-date methods of frozen sections of pathological tissues. Special staining methods are thoroughly demonstrated, notably the Krajian method for staining *Spirochaeta pallida*, elastic tissue stain, fat stain, and new stain for Amoeba in smears and tissues. A descriptive pamphlet of frozen sections is being distributed free of charge. Mr. and Mrs. Lucian Erskine will represent the school.

GUTHRIE CLINIC, ROBERT PACKER HOSPITAL
Sayre, Pa.

Booth Nos. C, D

Modern Surgery Aids the Crippled: As illustrated in this exhibit, shortening of the normal leg is an exact surgical procedure, having the advantage of utilizing a

normal structure rather than an atrophied or shortened bone. It is recommended as being the best method of leg equalization. Motion pictures in color and transparencies illustrate the operation and the before and after appearance of patients. A new principle, the insertion of a cup-shaped foreign body, has been applied in devising a plastic operation for the painful arthritic hip. Two satisfactory materials have been used for this purpose (vitallium by Venable and Smith-Peterson and lucite by Harmon).

HANOVIA CHEMICAL AND MANUFACTURING COMPANY

Newark, N. J.

Booth Nos. 204, 206

This is a comprehensive display of quartz mercury vapor arc lamps of the high pressure activated electrode self-lighting type. Working from alternating current and available in wattages from 100 to more than 4½ kilowatts, these high intensity ultraviolet sources will function equally well irrespective of position and are not as fragile as the older types which contained pools of mercury. Some of the finest examples of transparent fused quartz ware is displayed. Ultraviolet water sterilizers, milk irradiators and lamps for the destruction of bacteria and air-borne microorganisms are given a prominent place in the exhibit.

HAVERFORD COLLEGE

Department of Physics

Booth No. 107

Lecture and laboratory apparatus designed by Professors Sutton and Palmer for use in physics demonstrations, particularly in mechanics and electricity, is displayed. In some pieces the emphasis is upon simplicity; in others, upon their paradoxical behavior. Included are devices providing visual evidence of acceleration, torque, centripetal force, etc.; a modified mercurial barometer for multiplying ordinary deflections more than ten-fold; mechanical gadgets for showing peculiar effects of rotation; a constant-vision stroboscope for studying relative motions; several electrical circuits for demonstrating the behavior of condensers and inductances; a student apparatus for measuring electronic charge, and a projection model for illustrating atomic nuclear disintegration. The exhibit is attended by Professors R. M. Sutton and C. W. Holmes; and by Messrs. J. S. Laughlin, N. S. Brous, W. M. Harris and other Haverford students.

INSTITUTUM DIVI THOMAE

Cincinnati, Ohio

Booth No. 423

The effects of various respiratory-stimulating factors from cells in stimulating and inhibiting the growth of molds and bacteria are shown. The ability of these factors to antagonize the toxic effects of germicides and other drugs is illustrated. Demonstrations are made of the development of fields during the *in vitro* culture of tissue fragments in plasma. In plant physiology, results are shown on the measurement of the enlargement of cells, the production of solute, and suction tension, turgor and wall pressure of the growing epidermal cells of the hypocotyl of Helianthus seedlings. Professors J. C. Fardon and E. S. Cook are in attendance.

ROSCOE B. JACKSON MEMORIAL LABORATORY

Bar Harbor, Maine

Booth Nos. 130, 132

(Dr. C. C. Little, Director)

A display of some of the illustrations in the book "The Biology of the Laboratory Mouse" recently prepared by the staff of the laboratory and now in press is presented. There is also an exhibit of the so-called "milk influence" in determining the incidence of mammary tumors in mice and an exhibit of material showing change in function of the adrenal glands in some strains of mice following removal of the ovaries.

THE JOHNS HOPKINS UNIVERSITY

Department of Chemistry

Booth No. 417

(Dr. Dorothy Wrinch)

There is now little doubt that many biologically active proteins, in spite of their high molecular weights, have genuine molecular status. The central problem of protein chemistry is therefore to explain the existence of very large molecules, which are nevertheless physically and chemically well defined. This exhibit explains how *the fabric theory of protein structure* offers a solution to this problem. Models show how a fabric itself determines whether or not it can fold round to form cage-like structures and how the atomic pattern determines size and shape. These considerations explain the special molecular weights of the globular proteins and the reversible dissociation of which many proteins are capable.

LEEDS AND NORTHRUP

Philadelphia

Booth Nos. 321, 420

Leeds & Northrup is exhibiting in operation some of its latest developments: a temperature bath that is constant within 0.001 C; the most accurate equipment available for measuring temperatures between −190 and +500 C; a recording Microphotometer; an Optical Pyrometer and a portable pH Indicator.

E. LEITZ, INC.

New York

Booth No. 214

An entirely new line of domestically manufactured laboratory instruments is exhibited. Among these are the Leitz-Mass Photo-Electric Colorimeter, Leitz-Mueller Photometer, Leitz "G & D" Electro-Titrator, the new Leitz "G & D" PH Meter, etc. Also shown are Medical Microscopes as well as the latest type Research Microscope, "Ortholux," darkfield and vertical illumination equip-

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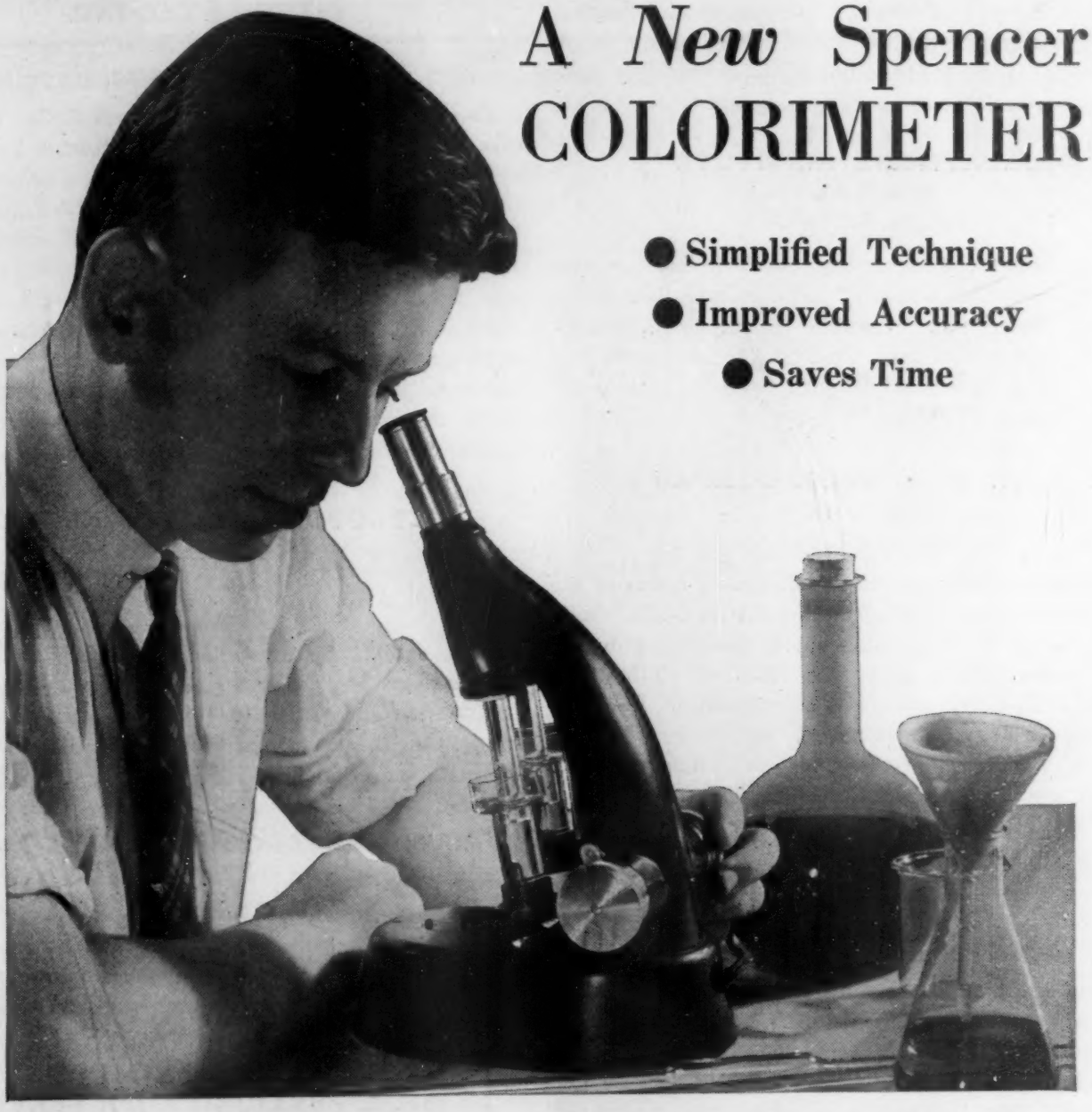

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Spencer Instruments will be demonstrated in Booths 221 and 223, at the annual meeting of the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Philadelphia, Pa., December 27–January 2.

ment, for every type of research microscopy and routine work. Photomicrographic apparatus, as well as our Leica Camera with its accessories for photomicrography and projection, particularly in color, are displayed.

LINGUAPHONE INSTITUTE
New York

Booth No. E

Language Courses: Linguaphone Institute has a unique exhibit. It consists of a display and demonstration of the home-study course now available in twenty-seven languages, together with a vast array of English speech material, including records of English Speech through the Centuries, English Phonetics.

McGRAW-HILL BOOK COMPANY
New York

Booth No. 220

Advance proofs of important forthcoming books in the field of science are on display at the McGraw-Hill booth. You are invited to see at this booth also an exhibit of recent McGraw-Hill books in the fields of Agriculture, Astronomy, Biology, Chemistry, Economics, Forestry, Geography, Geology, Mathematics, Metallurgy, Photography, Physics and Psychology. In attendance are Messrs. James S. Thompson, Curtis G. Benjamin, Norman R. Beers and Kenneth B. Demaree.

THE MACMILLAN COMPANY
New York

Booth Nos. 217, 219

The book exhibit sponsored by The Macmillan Company contains approximately eight hundred and fifty volumes—undergraduate and graduate text-books, reference books and technical and scientific books designed for the general reader. The following classifications are represented: Agriculture, the Biological Sciences, Chemistry, Engineering, History of Science, Home Economics, Mathematics, Medical Science and Physics. The following representatives of The Macmillan Company will be in attendance at the booths: Mr. T. C. Morehouse, Mr. C. L. Skelley, Mr. Dwight Hoover, Mr. Paul S. Eriksson and Mr. W. Arthur Evans, Jr.

MEMORIAL HOSPITAL
New York

Booth No. 128

(Halsey J. Bagg and Flora Hagopian)

The Relation of Hormonal Activity to Spontaneous Tumors of the Mammary Gland: Data are given showing the relation of disturbances in the functional activity of the mammary glands to mammary tumors in female rats and the association of this condition with abnormal hormonal activity in these animals. An extension of the above principle is shown in an experiment where male rats are the subjects. Also female dogs with spontaneous mammary gland cancer are used as patients, and the relation of suppressed ovarian function to the course of the mammary tumor is being studied. Preliminary results are summarized.

MERCK & CO., INC.
Rahway, N. J.

Booth Nos. 205, 207, 209

The keynote of the exhibit of Merck & Co., Inc., is the role of chemical research in national defense by service to the professions through provision of new products to aid nutrition and combat disease. The center panel of the booth shows the various vitamins of the B complex and is flanked by panels devoted to the elaboration of the syntheses of vitamin B_6 and pantothenic acid as recently carried out in the Merck Research Laboratories. The outer panels deal with the role of the drugs of the sulfanilamide series and of the quinine group in the prophylaxis and cure of disease in peace and war. Dr. C. R. Addinall is in charge of the exhibit.

METROPOLITAN LIFE INSURANCE COMPANY
New York

Booth No. B

This exhibit features the subject *Health Progress in Recent Decades.* It includes individual charts showing mortality trends since 1911 in cardiovascular, renal diseases, cancer, pneumonia, tuberculosis, diabetes, childhood diseases and accidents.

NATIONAL BROADCASTING COMPANY
New York

Booth Nos. 308, 310

This exhibit consists of visual and other informative material relating to the company's public service programs with emphasis on programs of educational value.

THE NATIONAL CANCER INSTITUTE, U. S. PUBLIC HEALTH SERVICE
Bethesda, Md.

Booth Nos. 125, 127

The exhibit describes the organization and activities of the National Cancer Institute. It includes charts showing the organization of the institute and pictures illustrating the work of the various divisions; maps and charts showing the location of hospitals receiving radium loans; the training of clinicians in the diagnosis and treatment of cancer; graphs showing the findings of statistical studies on morbidity and mortality from cancer, and samples of material used in our public health education work. A series of photomicrographic transparencies illustrating various types of tumors induced in rodents by carcinogenic hydrocarbons and azo dyes is also shown. Included in this material are tumors of the skin, brain, breast, lung, gastro-intestinal tract, salivary glands and liver.

NATIONAL GEOGRAPHIC SOCIETY
Washington, D. C.

Booth Nos. 224, 226

Work of Expeditions and Studies in Five Fields: Preliminary results of the work of five current scientific expe-

SPECIAL VITAMIN-FREE DIETS

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In the study of nutritional deficiencies, many investigators are confronted with the inconvenience of preparing special diet materials for their experimental animals.

Recent expansion of production facilities to meet our own rapidly growing requirements now enables us to offer special vitamin-free diets for nutritional research to those who do not have the time, facilities, or desire to prepare such products, as well as for those who may not be able to do so economically. Included in the diets designed to produce various vitamin deficiencies in experimental animals are: Vitamin-free Casein, Salt Mixtures, U.S.P. Vitamin A-free and Rachitogenic Diets.

In making these special SMACO products for nutritional research available, the facilities of this division of the Research Laboratories of the S.M.A. Corporation are, in effect, placed at the disposal of those engaged in nutritional investigations.

We shall be pleased to send a descriptive price list containing detailed information, on request.

RESEARCH LABORATORIES

S.M.A. Corporation

CHAGRIN FALLS, OHIO

ditions and investigations under the sponsorship of the National Geographic Society are shown in the exhibit of the society. Rare fossil bones found last summer in the Badlands of South Dakota illustrate work in paleontology; art objects from a pre-Christian-era civilization in southern Mexico represent archeology; and photographs, charts and one of the largest spectrograms ever made, obtained during the latest total eclipse of the sun, present astronomical data. Unusual photographs and charts depict progress of a three-year investigation of auroras, and oceanographic studies of the sea bottom. Mr. Kerbey and Mr. Roy are in attendance.

UNIVERSITY OF NEW HAMPSHIRE

Durham, N. H.

Booth No. 104

The exhibit describes the university campus, its dormitory facilities, its science buildings, its meeting places, its dining halls, its recreation facilities, and its relative position in the vacation land which is New Hampshire and New England. Enlarged photographs of the university campus, the recreation regions of the state and a large directional map showing the main highways and railroads and airlines converging on Durham comprise the main feature of the exhibit. The map also includes directions to New England and Canadian points. Colored slides of New Hampshire are shown.

NEW YORK STATE COLLEGE OF AGRICULTURE

Department of Ornamental Horticulture, Cornell Universty

Booth No. 105

The exhibit consists of three landscape models. An experiment in perception in relation to landscape design is conducted to determine the most pleasing proportions for rectangular lawn panels. This experiment is one of a series to accumulate quantitative data on the influence of various landscape treatments. The use of models in the teaching of landscape design and the possibility of their practical application to commercial landscape design are also being studied. All in attendance are invited to come and vote.

UNIVERSITY OF PENNSYLVANIA AND COOPERATING INSTITUTIONS

Abington Memorial Hospital and Graduate School of Medicine

Booth Nos. 426, 428

The exhibit consists of charts, bony specimens and x-rays illustrating the chief types and pathological features of the rheumatoid syndromes. The incidence and morbidity of rheumatoid diseases and the economic cost occasioned by them will be illustrated. The physiological deviations underlying the various symptoms will be outlined, together with certain therapeutic implications. This is the work of Doctors Pemberton, Bach, Hollingsworth, Kelchner, Westcott and Scull.

Astronomy

Booth No. 425

Prints of Milky Way photographs from Cook Observatory are shown. Exhibited also are instruments used in the astronomical work of the university. Maps, blanks, pamphlets, etc., dealing with work of American Meteor Society are on display.

Department of Botany

Booth No. 401

(John M. Fogg, Jr.)

Studies Leading to a Comprehensive Account of the Plant Life of Pennsylvania: This exhibit illustrates some of the methods employed in recording and mapping the distributional data for the 3000 species of ferns and flowering plants which grow wild in Pennsylvania. Actual range maps show correlation between distribution and such factors as soils, temperature, rainfall, etc. The cooperation of leading institutions, such as the Carnegie Museum and the Philadelphia Academy of Natural Sciences, is emphasized. Examples are shown of the type of illustrations being prepared for the intended publication.

Dental School

Booth No. 115

(Leroy M. Ennis)

The exhibit from the Dental School attempts to illustrate a few of its activities: the route by which bacteria reach periapical region, the development of temperomandibular joint, static and sliding friction between enamel and amalgam, clinical laboratory tests of patients with and without parodontosis, the composition and density of dentin in caries and the effect of saliva on tubercle bacilli.

The School of Education

Booth No. 109

The exhibit consists of types of research material in the Penniman Library, some of the publications of the faculty and students of the School, samples of other research and service activities of the faculty, material descriptive of the work of the Cultural Olympics and samples of the work of students in the Fine Arts.

Engineering Schools

Booth No. 213

Displayed are rare prints from the Edgar Fahs Smith Memorial Collection on the History of Chemistry, tracing the evolution of chemical laboratories from their inception and concluding with the plans of the new laboratory about to be constructed at the University of Pennsylvania. The Schlieren Effect is demonstrated by exceptional photographs. Numerous unusual mathematical instruments and indicators are exhibited, including a complete integrator and torque amplifier unit which is one of fourteen units used in the differential analyzer in the Moore School. Relay testing panels, photographic x-ray, and an automatic trigonometric analyzer are shown, to-

gether with photographs of research projects including a root extractor.

School of Fine Arts
Booth No. 211

The Department of Architecture of the School exhibits two student problems in architectural design embracing engineering of illumination, a powerhouse and transportation and two models used in teaching, one illustrating wood construction of a frame house and another demonstrating steel construction, with full scale items of joinery, steel structural welding and riveting.

Forest Pathology
Booth No. 400
(Harlan H. York)

This exhibit gives an idea of the nature and scope of the scientific investigations on diseases of white and red pine in forest plantations which are being conducted from the University of Pennsylvania with the cooperation of the Conservation Department of New York and the city of Rochester, New York. It consists of two main divisions which are the use of carefully prepared specimens which illustrate both the external and the internal effects of the fungi involved in the diseases shown and the results of the use of certain chemicals in diagnosing internal disturbances due to Polyporous Schweinitzii and other causal agents.

The Department of Geography
Wall Spaces X, Y

This is an exhibit of maps showing the various phases of the environment and human development of Philadelphia and vicinity. Through the courtesy of the Pennsylvania State Planning Board, the department is exhibiting maps portraying land use, transportation routes, and density of population for the State of Pennsylvania. The Interstate Commission on the Delaware Basin is furnishing maps showing density of population, transportation routes, land use, and the water resources of the Delaware Basin. The Institute of Local and State Government of the University of Pennsylvania is furnishing aerial maps, relief maps and a regional plan for the Philadelphia area.

Harrison Department of Surgical Research
Booth No. 424
(John H. Gibbon, Jr., M.D., Mary H. Gibbon and Charles Kraul)

Temporary Maintenance of the Cardio-Respiratory Functions in Whole Animals: The apparatus for withdrawing venous blood, introducing oxygen and returning the blood to the animal's arteries is exhibited. With this apparatus life has been maintained in animals with the pulmonary artery completely closed. Four animals lived from one to nine months after occlusion of the pulmonary artery of from twelve to twenty minutes. Control animals exhibited permanent neurologic injury after five minutes, and died after eight minutes, of occlusion of the pulmonary artery.

Medical School
Booth No. 430
(Christian J. Lambertsen)

A simple, self-contained apparatus designed for respiration under water and in atmospheres of noxious gases is displayed. The simplicity of structure and operation make the diving apparatus practical for use in rescue of persons drowning in deep water, recovery of bodies and lost articles from deep water, minor diving operations. With slight modification it may be used as an industrial gas mask.

William Pepper Laboratory, Hospital of the University of Pennsylvania
Booth No. 422

This exhibit includes an apparatus utilizing the thermoelectric method for measuring vapor pressure in aqueous solutions by Dr. F. William Sunderman; by Dr. Leon Jonas a photo-electric colorimeter so arranged that a galvanometer can be attached for measuring fluorescence; by Dr. James S. Forrester a comparative study of results obtained for diagnosis and control of therapy in chronic gonorrhea of the female genital tract are shown (this study is part of the nation-wide campaign); by Dr. David H. Black a nomogram, newly designed reporting form and the simple apparatus necessary for use in Rourke-Ernstene method for determining sedimentation rate of red blood cells.

Department of Physiology
Booth No. 430
(Arnoldus Goudsmit, Lawrence Louis, H. C. Bazett)

Measurements of Extracellular Fluid Volume in Man: This exhibit shows methods by which the volume of extracellular fluids has been measured as the weight of water available for the distribution of the bromide and thiocyanate ions. These substances are delivered simultaneously and intravenously. Ultimately an equilibrium is reached, but much more time is required than has been commonly assumed. This investigation is part of a larger program of research on climatic influences on the human body and is aided through a grant from the John and Mary R. Markle Foundation.

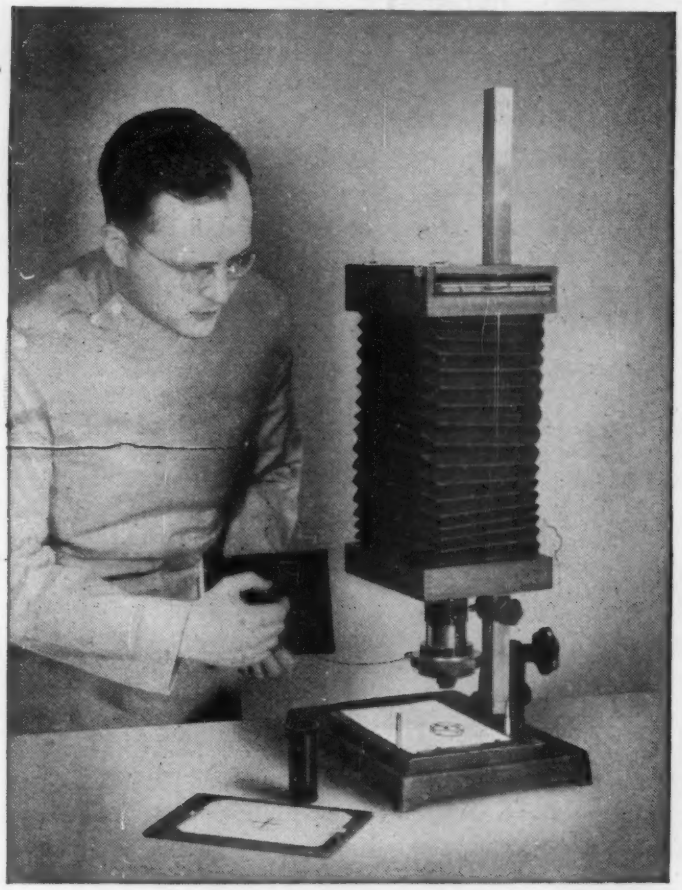
Wharton School of Finance and Commerce
Booth No. 114

This exhibit portrays the extent of the research assistance which the Wharton School contributes to private industry and to government. The Department of Industrial Research displays charts which are typical of those arising from its work. The Institute of State and Local Government exhibits various studies it has contributed to governmental units in the State of Pennsylvania.

Department of Zoology
Booth No. 402

Exhibited are drawings and photographs of the giant salivary-gland type chromosomes of the fly Sciara, illustrating evolution of species differences by minute changes

(*Continued on p. 20*)



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LABORATORY APPARATUS AND CHEMICALS

(*Continued from p. 11*)

in visible chromosome structure. Species-hybrid types are shown. Also displayed are paintings of mutant types in colors of eyes and body in the wasp Habrobracon including multiple mutant types and genetic mosaics. A living pigeon infected with a protozoan parasite (Trichomonas gallinae) of the mouth and crop is exhibited.

THE PHILADELPHIA COUNTY MEDICAL SOCIETY

Booth No. 129

The exhibit describes the many and varied activities of the Society, representing over two thousand five hundred physicians in Philadelphia. It includes a film showing medical progress and present medical and hospital institutions in Philadelphia, and a film portraying the various steps in the education of a physician.

PHIPPS AND BIRD, INC.

Richmond, Virginia

Booth No. 323

Newer apparatus for use in physiology, pharmacology, and psychology is exhibited. Of particular interest is the Phipps and Bird Continuous Feed Kymograph, which, using ink writing levers, permits records of any length up to ninety feet to be made without paper adjustment troubles common to the regular long paper kymograph. The Phipps and Bird vertical, electrical student kymograph is also shown. Ink writing tambours, muscle levers, heart levers, pressure manometers, and signal magnets for both vertical and horizontal recording are displayed. L. C. Bird, Pat Gaskins and R. R. Chappell are in attendance.

POLAROID CORPORATION

Cambridge, Mass.

Booth No. 419

Polaroid Corporation exhibit light polarizing materials and several new experimental kits for school and college use in instruction in polarized light. These include an all-purpose kit primarily for optical-bench assemblies, another adapted to the Optical Disc, and two designed for use with common horizontal projection lanterns, including one for demonstrations of photoelasticity. Three-dimensional (stereoscopic) projection pictures are also shown. In attendance are Dr. Martin Grabau, Mr. Cameron and Mr. Kriebel.

PRENTICE-HALL, INC.

New York

Booth No. 215

Important new scientific publications are again featured in the book exhibit presented by Prentice-Hall. The display includes undergraduate and graduate texts in Physics, Chemistry, Mathematics and Engineering, as well as in Psychology, Geography and the Social Sciences. Of outstanding interest are Herzberg's "Molecular Spectra and Molecular Structure," Albright's "Physical Meteorology," Rollefson and Burton's "Photochemistry," Middleton and Willard's "Semimicro Qualitative Analysis," Taylor's "Vector Analysis," Bircher's "Physical Chemistry," and "Applied General Statistics" by Croxton and Cowden, all recent publications. Also featured are Haskins' "Of Ants and Men" and Strong's "Procedures in Experimental Physics." Mr. J. S. Bauer and Mr. Craig Senft are in charge.

RCA LABORATORIES

Booth Nos. 312, 314

The applications of the electron microscope to scientific and industrial research are illustrated by means of pictures taken with this instrument. Various electron tubes and special measuring apparatus of particular interest to laboratory workers are on display.

THE RESEARCH COUNCIL ON PROBLEMS OF ALCOHOL

Bronxville, N. Y.

Booth No. 112

This exhibit is a presentation of the problem of alcoholism on which the Council is at present concentrating its attention, and of its program for dealing with the problem. Placards, graphs and photographs present the extent and the seriousness of the problem, the backwardness of the United States in respect to hospitals and clinics for alcoholics, and the present lack of funds for research. Copies of the Council's official organ, the *Quarterly Journal of Studies on Alcohol*, and other printed matter are available. Dr. Winfred Overholser, superintendent, St. Elizabeths Hospital, Washington, D. C., is chairman of the Board of Directors; the chairman of the Scientific Committee is Dr. Karl M. Bowman, director of Psychiatry, Bellevue Hospital, New York, and Harry H. Moore, Ph.D., is director of the Council.

RUBICON COMPANY

Philadelphia

Booth No. 216

Included among a group of precision instruments chosen to partially illustrate the scope of the Rubicon Company's activity are the type B precision potentiometer combining high accuracy and wide range with great manipulative convenience; several "spotlight" galvanometers, sturdy, extremely stable self-contained instruments with exceptionally high sensitivities obtained by internal multiple-reflection optical systems; a precision Kelvin bridge; and the Evelyn photoelectric colorimeter, a versatile instrument of extensive applicability in colorimetric and turbidimetric chemical analyses. Messrs. Josef Doerr, E. W. Kiefaber, N. E. Bonn and W. H. Schaeffer are representing the company.

W. B. SAUNDERS COMPANY

Philadelphia

Booth No. 230

The exhibit includes a complete line of textbooks and reference books dealing with the medical and biological sciences. Of special interest are the new textbooks, "Physiology of the Fetus" by Windle, the new "Labo-

ratory Manual in Biochemistry'' by Harrow and the new edition of ''Physical Diagnosis'' by Majors, ''Medical Biometry'' by Pearl, ''Preventive Medicine'' by Boyd, ''Developmental Anatomy'' by Arey, ''A Textbook of Physiology'' by Howell, ''Elementary Bacteriology'' by Greaves, ''Fundamentals of Bacteriology'' by Frobisher, and ''Textbook of Biochemistry'' by Harrow. The representatives present during the convention are: Messrs. E. R. Zieber, John A. Behnke, Donald G. Baird and R. V. Thayer.

SCIENCE LIBRARY
Publications of 1940
Booth Nos. 409, 411, 413, 415

This display is a popular part of the annual exhibition of the American Association for the Advancement of Science. It is a collection of approximately six hundred volumes issued during 1940 by more than fifty publishers. Those attending the meetings and exhibition are invited to visit the Science Library. It is a convenient place for members to meet their friends. Tables and comfortable chairs are conducive to a leisurely examination of the books. Reprints from the January issue of *The Scientific Monthly*, in which the publications are catalogued, are distributed without charge to those interested. Staff members of the Library of the University of Pennsylvania are in charge.

THE SCIENCE PRESS PRINTING COMPANY
Lancaster, Pa.
Booth No. 318

Publications printed by The Science Press Printing Company are exhibited. Books and journals can be examined and orders placed. Blanks for inclusion of biographies in the Seventh Edition of ''American Men of Science'' can be filled out. Information and suggestions are given concerning the methods and costs of scientific printing. Mr. Jaques Cattell is in charge.

THE SEOSCOPE
Delaware, Ohio
Booth Nos. 101, 102

The exhibit of the seoscope attempts to show such scientific phenomena as cell division, conjugation, circulation of blood, protoplasmic motion, growth of pollen tubes, heart beat of water animals, action of young inside the bodies of water fleas, various interesting experiments on polarized light and many other phenomena not usually seen by the students in high-school science classes. Live materials are used as demonstration material. Emphasis is placed on the simplicity and flexibility of modern microprojection. Mr. Raymond D. Gross and Mr. William J. McNabb are in charge of the exhibit.

SHALLCROSS MANUFACTURING COMPANY
Collingdale, Pa.
Booth No. 208

This company displays and demonstrates the well-known Shallcross ''Akra ohm'' accurate resistors, 1%, .5%, .25% and 0.1%, rotary selector switches and instruments used in electrical measurements, such as resistance standards (one to six dial), decade potentiometers, decade resistance boxes (.1 ohm to 110 megohms), Wheatstone and other bridges, special apparatus for the measurement of high potentials such as portable kilovoltmeters and the well-known Taylor high voltage resistors for potentials up to 300 k.v. In addition is displayed a number of special instruments such as the electrolysis meter, electro clinical thermometer, multimeters, megohmmeters, decibel meters and attenuation pads. Representatives in attendance are D. H. Shallcross, J. S. Shallcross, F. D. Mitchell and D. H. Shallcross, Jr.
colorimeters.

SPENCER LENS COMPANY
Buffalo, N. Y.
Booth Nos. 221, 223

Scientists are invited to inspect several new optical instruments. Accessories including lamp, mirror and filters for fluorescence microscopy useful in the identification of acid-fast bacteria such as tuberculosis bacilli, and a new polarimeter, ideal for the lecture room or science laboratory, are shown to A.A.A.S. members for the first time. The Spencer Direct Result Colorimeter and Stereoscopic Microscopes, offered for sale since the last meeting, are available for inspection. Research and laboratory microscopes, microtomes, photomicrographic cameras, Delineascopes and many other scientific instruments are set up for use. Mr. Wm. F. Butler, Mr. A. R. Silberg and Mr. G. W. Frid are in attendance to discuss any optical questions that visitors have in mind.

ARTHUR H. THOMAS COMPANY
Philadelphia
Booth Nos. 304, 306

This exhibit includes the latest models of this Company's water jacketed incubator, Board of Health model, horizontal autoclave for bacteriological laboratories, Wiley laboratory mills, Stormer viscosimeters, microtome knife sharpeners, electric vacuum drying ovens thermostatically controlled, hematological specialties, Boerner shaker, micro-chemical specialties, also their Red Label (English) micro cover glasses and Serfass electron ray titration outfit. In addition, there is on display the Beckman pH meters and the Klett-Summerson photoelectric colorimeters.

U. S. DEPARTMENT OF AGRICULTURE
Washington
Booth Nos. 427, 429, 431, 433

The exhibits consist of displays illustrating the application of science to the following subjects: *Soil Conservation:* Panels of photographs and legends illustrate the research work of the Soil Conservation Service, and show why the practices which result from research are conducive to more effective conservation. *Agricultural Chemistry and Engineering:* Panels of photographs, legends

and samples of products provided by the Bureau of Agricultural Chemistry and Engineering show industrial uses of the following agricultural products: gum naval stores; sweet-potato starch; cereal straws; western hemlock bark; soybeans; and corn stalks. *Land-Use Planning:* A portrayal, by the Bureau of Agricultural Economics; the planning function of the Department of Agriculture, of practices advocated within the land-use planning program and how they contribute to better farming, and to better living in farm communities. *Aerial Maps and Surveys:* Photographs and photographic maps by which the Agricultural Adjustment Administration illustrates processes employed in the making of aerial maps and surveys used in the Agricultural Adjustment Administration program and also in various other fields.

UNIVERSITY PRESSES
A Cooperative Exhibit

Booth Nos. 320, 322

Fourteen University Presses will display recent publications reporting and interpreting original research in scholarship, textbooks exemplifying new methods, and proceedings and reports of learned societies. The cooperating Presses include: Chicago, Collegiate (Iowa State College), Columbia, Cornell, Harvard, Minnesota, North Carolina, New York, Oklahoma, Oxford, Princeton, Stanford, Wisconsin.

WARREN-KNIGHT COMPANY
Philadelphia

Booth No. 110

At our exhibit we are demonstrating how liquid Latex is used in making *negative* molds and how pre-vulcanized Latex (Wakco Castex) is used in making *positive* casts. The latter is available in several consistencies, which makes it adaptable to practically every use to which the scientist may put it. The exhibit includes a complete line of modeling, molding and casting materials among which are the Plastico Moulage and the new Wakco Latex. In addition to a variety of scientific instruments there is also displayed a complete line of Wrico lettering guides similar to those which we have furnished to scientists for many years, and *new* Wricoprint lettering sets.

W. M. WELCH SCIENTIFIC COMPANY
Chicago

Booth No. 119

The exhibit contains several noteworthy operating setups: (1) Showing the brilliancy and resolving power of the Wood replica diffraction gratings; (2) a working exhibit of Geiger-Muller counter tubes as applied to the recording of cosmic and gamma rays; and (3) an assembly of nuclear physics apparatus designed after suggestions of Professor J. Barton Hoag, including the well-known Hoag-Millikan oil-drop apparatus, x-ray absorption screen and other familiar pieces and a new "probe tube" for making quantitative determinations of current and voltage characteristics at various reduced pressures. In addition the exhibit contains examples of standard and improved designs of physics and chemistry apparatus of Welch manufacture.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY
Pittsburgh

Booth No. 316

This exhibit shows the Westinghouse Sterilamp—Science's latest contribution to the effective control of surface and air-borne bacterial contamination by means of selective ultraviolet radiation. Bactericidal ultraviolet radiation and its uses in hospitals, in the field of Public Health, and in food preservation are described verbally and pictorially. The actual destruction of micro-organisms by radiation from Sterilamp is shown in motion pictures.

JOHN WILEY AND SONS, INC.
New York, N. Y.

Booth No. 421

The display consists of the recent books published in all the fields of science and technology covered by the publications of the company. Special attention is directed to the books now published, comprising The Science Survey Series, edited by Dr. Gerald Wendt, particularly the book on Geology by J Harlan Bretz. Other new books of interest are Ellsworth Huntington's "Principles of Economic Geography" and Baver's "Soil Physics." The company is represented at the exhibit by Mr. W. B. Wiley, Mr. J. S. Barnes, Mr. J. K. Maddock and Mr. Gordon Ierardi.

THE WISTAR INSTITUTE OF ANATOMY AND BIOLOGY
Philadelphia

Booth No. 228

Work of Dr. Helen Dean King: The mutations demonstated (black, ruby-eye dilute, albino, waltzing, curly, cinnamon and stub) were derived from a strain of gray Norway rats bred through 45 generations comprising more than 100,000 individuals. *Work of Dr. R. Cranford Hutchinson:* When white non-metamorphosing Mexican axolotls were crossed with Amblystoma tigrinum the hybrids were pigmented and metamorphosed. The second generation comprised: colored metamorphosing, colored non-metamorphosing, albino metamorphosing, and albino non-metamorphosing individuals. *Work of Dr. Clyde E. Keeler:* In rats high-roofed, pentagonal formamens and low-roofed, oblong formens are extreme variates of a normal distribution in all strains studied. Dr. Keeler is in charge of the exhibit.

THE ZOOLOGICAL SOCIETY OF PHILADELPHIA
Booth No. 126

The work of the Laboratory of the Philadelphia Zoological Garden (the Penrose Research Laboratory), is illustrated by transparencies showing the existence of two very important diseases in both man and the lower animals—hardening of the arteries and chronic arthritis. The laboratory display is arranged by Dr. Herbert Fox In attendance are Freeman M. Shelly, director, and Roger Conant, curator.

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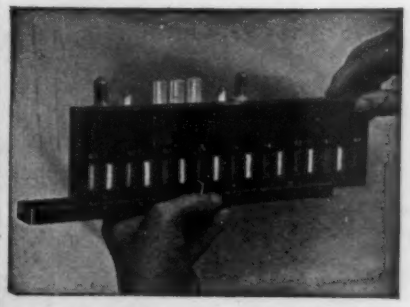

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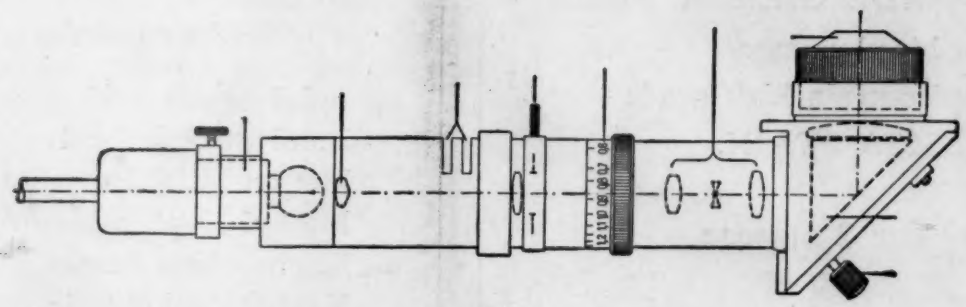

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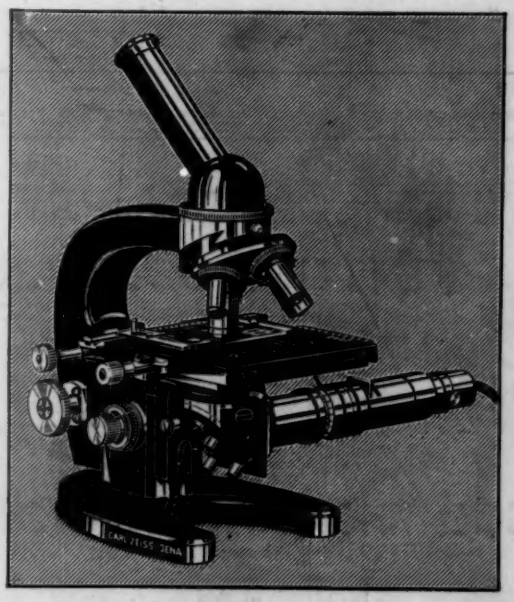

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